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ORIGINAL MEMOIRS.

FILARIASIS.

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FILARIASIS is an endemic parasitic disease of surgical interest because of certain local manifestations produced by the parasites in the lymphatic system which may be benefited by surgical measures.

Manson, whose work upon this subject has extended over a period of twenty years, states that there are four well-known nematodes which inhabit the circulation, and that there are probably other species. He gives the following nomenclature: The original filarial embryos, described by Lewis, are the ones which concern us here, and have been given the name *Filaria nocturna.* The other filariæ he has termed *Filaria diurna, Filaria perstans,* and *Filaria Demarquaii.* Two doubtful species he gives the names of *Filaria Ozzardi* and *Filaria Magallhaesi.* Prout has recently described another blood-worm under the name of *Filaria gigas.*

No pathological importance is attributed to any of these parasites except to the filaria nocturna, which is the embryonic form of the adult worm Filaria Bancrofti, whose natural habitat is the lymphatic system of man.

Filarial disease occurs endemically in tropical and subtropical countries, and is prone to exist along the seacoast and large rivers. The origin of the sporadic cases, occasionally encountered in the colder climates, can usually be traced to one of the following geographical regions: India, Ceylon, China, the Malay Archipelago, Japan (particularly the most southerly islands), Egypt, East Africa (especially along the coast of Zanzibar), Mombasa and Tanga, the West Coast of Africa, Senegambia, Madagascar, and Orange River Colony (Bloemfontein), Reunion, Mauritius, Australia (Queensland), New Caledonia, the South Sea Islands, Guiana, Brazil, United States of Colombia, West Indies, and Spain.

In the filarial districts a large proportion of the population is affected by the disease. In Amoy (China) Manson found one-eighth of the population affected. Thorpe found twenty-five per cent. of the natives of the Fiji Islands affected, and thirty-two per cent. of the Friendly Islands. In southern India, in the districts of Travancore and Cochin, Underwood reports one-tenth of the whole population as afflicted. Koniger states that fifty per cent. of the male population of Samoa have filariasis. According to Saville seven-tenths of the adult males of the island of Huahine, one of the Friendly group, suffer from the disease.

Vincent tabulates five hundred cases taken indiscriminately from among patients at the Colonial Hospital, Port of Spain, and St. Anne's Lunatic Asylum, and from private sources. The percentage of blacks with filariasis was 4.9, of whites 10.9, and of East Indians 2.4. The percentage of infection in the case of the whites is strikingly high. The white population of Barbadoes and Demarara show a high percentage of infection, and in Trinidad, 14.5 per cent. of the white population are infected with this disease.

Indigenous cases in the southern part of the United States are on record. De Saussure, in 1890, reported twenty-two cases that he had observed in Charleston, S. C. Slaughter, in 1891, reported two indigenous cases in the northern part of Virginia. Mastin, in 1888, found such a case in Mobile, Ala.,

and Dunn has demonstrated filaria embryos in a woman who has always lived in Pennsylvania. Guiteras, in 1886, called attention to the presence of the disease in the southern states, four in Key West and one in Charleston, S. C. Cases occurring in the seaport towns can be explained by the constant communication with the filarial districts, but the origin of the indigenous cases is more difficult to understand.

The following case, a native of the United States of Colombia, was referred to me by Dr. C. H. Le Franc, of Cartegena, in May, 1904:

D. M., 35, M. Merchant; Spaniard; South American born.

Family History.—Excellent.

Past History.—No severe illnesses. Gonorrhœa three times, last attack twelve years ago. No complications or sequelæ.

Present Illness.—In 1885 the patient had a severe attack of "chills and fever" which confined him in bed for two days. Associated with the fever there was moderate swelling of the scrotum and severe pain in the lumbar region. Nothing abnormal regarding the urine was noted. The "chills and fever" ceased in a few days, but the swelling of the scrotum persisted in slight degree. There was a similar attack once every year until 1892, when the pain in the back was much more severe and the urine became bloody. The scrotum at this time was the size of a cocoanut, and bunches, the size of the fist, appeared in each inguinal region. The "chills and fever" continued about four weeks, during which time the patient was confined to bed. As the "chills and fever" subsided, the swelling in the scrotum disappeared, and those in the groin diminished in great part. Diarrhœa was profuse at this time. The hæmaturia continued for three months. During this attack of hæmaturia he came to Boston and saw Dr. Arthur Cabot, who found filarial embryos in his blood.

The attack the following year, 1893, was less severe and he had no associated hæmaturia or diarrhœa, although the scrotum was abnormally large and the tumors in the inguinal region became enormously swollen. In 1894 there was again hæmaturia lasting one month. The pain in the back was severe at this time.

These attacks of chills and fever and swelling of the scrotum

without further hæmaturia occurred once yearly until 1902, during which year he had three attacks of the same character already noted, associated with severe diarrhœa. At no time did the patient pass chylous urine. There was no frequency of urination, or difficulty or pain in performing the act except during the attacks of hæmaturia, at which time the passage of small blood-clots caused considerable pain.

The scrotum has remained swollen between the attacks, and there has been considerable pain in the region. There has also been constant dull lumbar pain. The scrotal pain was constant, of a dull, heavy dragging character, and was aggravated by walking or riding, and for which he has worn a supporter since 1892. It has been necessary for him to give up horseback riding for the last few years, on account of pain of a severe, sickening character radiating from the perineum into the epigastrium, causing him to become nauseated.

The patient states that he has suffered from melancholia for the past seven years, but there is no definite history pointing to this mental disturbance.

Dr. Le Franc states that when the scrotum and inguinal regions were acutely enlarged he believed there was fluid in the tunica vaginalis. The swellings subsided with the application of hot fomentations.

Physical Examination.—Well developed and nourished. Dark complexioned. Heart and lungs normal. Abdomen full, lax, tympanitic, not tender. Liver area normal, not felt. Spleen not felt; area not increased. Neither kidney palpable. Fulness throughout the course of both inguinal canals, producing an elongated swelling slightly more on the right than left, about one inch high and two inches wide, extending from the scrotum to the internal abdominal ring. These swellings are firm, but not hard, tender, or movable. They are deeply situated and continue into the scrotum along the spermatic cord. The scrotum is enlarged downward and laterally and appears distended by masses within. It is slightly fuller on the right than on the left side. Palpation shows a mass somewhat larger than the fist in the right upper quadrant; it is continuous with the mass in the right inguinal region and resembles a varicocele to the touch. This is continued downward along the course of the spermatic cord.

The vas deferens is clearly defined posteriorly. The right testicle is displaced into the perineum about one inch below the scrotum, and perineal junction. It is easily replaced into the scrotum, but drops back immediately when not held.

A similar but smaller mass is present in the left upper quadrant of the scrotum, which also continues downward along the spermatic cord, from which it is easily differentiated posteriorly. The cord on this side is slightly lengthened and presents the same character as that on the other side, and the testicle, which like its mate is normal in size and shape, is situated a little lower than normally.

The external inguinal ring on both sides, although only admitting the tip of the index-finger, because of continuation of the masses already noted into the inguinal canals, are considerably enlarged. There is no impulse or expansion of the masses on cough.

The skin of the scrotum is not thickened nor otherwise abnormal in character. No fluid is demonstrable in the tunica vaginalis, either by palpation or by the hydroscope. The cremasteric reflexes are equal and lively. The scrotum is diminished about one-third in size when the patient is lying flat. It is also diminished by the application of cold. The urethra admits a 27 *bougie à boule* to the triangular ligament and no obstruction is met in withdrawing it. The sound, 27 F., is passed into the bladder without meeting obstruction or deviating from a median line.

The *rectal examination* shows the prostate to be normal in size, shape and contour, with a distinct median raphe. Both seminal vesicles are normal by palpation.

Extremities normal. Reflexes equal and lively. No general or local glandular enlargement.

Urine Examination.—Color normal; sp. gr. 1014; acid; no albumin, bile or sugar; urea 2.8; cryoscopic freezing point 2.1; no apparent sediment. Centrifugalized urine shows no cells or casts. Occasional normal blood-corpuscles. A few sodium urate crystals. No embryo filaria found in many examinations at different times of day and night.

Blood Examination.—The blood examinations at different times are as follows:

May 12, 1904 (3 P.M.).—White cells, 5,200. Red cells, 5,640,000. Hgb. 90 per cent. No filariæ.

Differential count of 100 cells:

Lymphocytes	38.
Mononuclear leucocytes	4.
Polynuclear leucocytes,	51.5
Eosinophiles	6.5

May 14, 1904 (4 P.M.).—White cells, 5,600. Red cells, 5,600,000. Hbg., 90 per cent. No filariæ.

Differential count of 100 cells:

Lymphocytes	36.
Mononuclear leucocytes	6.
Polynuclear leucocytes	50.5
Eosinophiles	7.5

(12 Midnight).—White cells, 11,5000. Red cells, 5,102,000. Hgb., 90 per cent. Many filariæ.

Differential count of 100 cells:

Lymphocytes	40.
Mononuclear leucocytes	6.
Polynuclear leucocytes	35.5
Eosinophiles	18.5

May 16, 1904 (3 P.M.).—White cells, 5,4000. Red cells, 5,120,000. Hgb., 95 per cent. No filariæ.

Differential count of 100 cells:

Lymphocytes	30.
Mononuclear leucocytes	4.5
Polynuclear leucocytes	60.
Eosinophiles	5.5

(11 P.M.).—Many filariæ.

Differential count of 100 cells:

Lymphocytes	45.
Mononuclear leucocytes	4.5
Polynuclear leucocytes	31.5
Eosinophiles	19.

May 18, 1904 (3 P.M.).—Examination by Dr. Pratt:

Erythrocytes	5,504,000
Hæmaglobin	100 per cent. (Sahli).

No leucocytosis

Differential count of Leucocytes	Percentage.
Eosinophiles	7.1
Polynuclear leucocytes	52.2
Lymphocytes	37.
Large mononuclear leucocytes	3.3
Mast cells	.4
	100.0

292 leucocytes counted.

(12 Midnight).—White cells, 12,600. Many filariæ.

Differential count:

Lymphocytes	36.
Mononuclear leucocytes	6.
Polynuclear leucocytes	37.5
Eosinophiles	20.5

June 7, 1904 (11 P.M. 18 days after operation).—White cells, 5,000. Red cells, 5,280,000. Hgb., 100 per cent. No filariæ found.

Differential count:

Lymphocytes	28.
Mononuclear leucocytes	4.5
Polynuclear leucocytes	62.5
Eosinophiles	5.

Patient was seen in consultation by Dr. Abner Post and Dr. Joseph H. Pratt.

Operation.—May 20, 1904. Ether. Incisions about eight inches long, extending from the internal abdominal ring downward over the anterior surface of the scrotum along the course of the spermatic cord. The masses previously noted were found to be enormously enlarged lymphatics, and to a less extent dilated veins of the spermatic cord. As these continued into the inguinal canal, the fascia of the external oblique muscle was incised up to the internal abdominal rings. The vas deferens on both sides were dissected from the enormously dilated lymphatics, leaving a small amount of adjacent tissue for blood supply. The testicles, normal in every respect, were left attached to the vas of their respective sides. The cords, however, were ligated at a point about three-quarters of an inch above the epididymis. A clamp was applied about one centimeter above the tie and the cord cut between, with a small escape of chylous fluid, which was caught on swabs for examination. The masses were somewhat diminished in size as they disappeared into the abdomen through the

internal abdominal rings. These were transfixed at this point and tied. The mass was clamped just below the tie and cut between, with an escape of chylous fluid as before.

The testicles were then attached, by a mattress suture passed through the cut end of the cord, to a septum of the scrotum on either side, so that they assumed a normal position. The vas deferens on each side was placed in its normal position in the inguinal canal and the fascia of the external oblique muscle was sutured by continuous chromic gut sutures. The superficial fascia was sewn in a like manner, and the external wound brought together by silkworm-gut sutures, while the scrotum wound was sewn by continuous chromic gut. A dry sterile dressing and a T-bandage were applied, with the scrotum elevated. Duration of operation one and one-half hours.

The patient took ether badly throughout the operation, frequently hiccoughing. About fifteen minutes after being removed from the table the patient, although having had a pulse of about 110 throughout the operation, was found to be pulseless. Strychnia, one-thirtieth of a grain, was given subcutaneously. Heaters, blankets and elevation of the foot of the bed failed to produce a pulse of such a character that it could be counted. The patient was given three shock enemas consisting of coffee, brandy, and salt solution, at intervals of one-half hour. These did not materially improve his condition.

His skin and mucous membrane were blanched, and as he came out of the ether he was very restless, desired to be fanned, was very thirsty and complained of a sense of oppression. This, together with a barely perceptible pulse, pointed strongly toward hæmorrhage. Examination of the wound two hours after operation failed to reveal anything other than a slight ooze. Percussion of the abdomen gave no signs of internal hæmorrhage except for dulness in the left flank, which did not move with change of position, and which might well have been the retained shock enemas.

The patient was given fifteen minims of tincture digitalis intra-muscularly every three hours, and received one litre of normal saline solution under the breast, about two and one-half hours following operation. The condition certainly suggested internal hæmorrhage, and, although special care was taken in

tying off the spermatic cord, it was feared that bleeding was taking place from one of these stumps. However, operative interference was absolutely contraindicated on account of the patient's low condition. At the end of eight hours his condition remained practically the same, which fact, together with the knowledge of his condition immediately following operation, pointed less strongly toward hæmorrhage, the classical and technical signs of which still remained.

He was blanched and restless. Respiration 60 a minute. Temperature, 94°. Semi-conscious, feebly requesting water and air. Ten hours following operation the pulse became of slightly better quality, although it was still too rapid to be counted. From this time on his pulse gradually improved in quality, and the following day ranged between 150 and 160, but was decidedly thready in character. Forty-eight hours following operation the pulse had reached 120 and was of better quality; the temperature had jumped to 100.5°, and his general condition was fair, although he still remained blanched.

The patient improved slowly from this time, and one week following the operation the pulse was 80, of good volume and tension, and the respirations and temperature were normal.

The wounds healed by first intention and the stitches were all removed on the tenth day. The patient was up on the twentieth day following operation, and was discharged from the hospital June 9, 1904.

The blood was examined several times for filariæ beginning twelve days after operation, but none were found.

The day following discharge from the hospital the patient noticed a small swelling in the upper part of the left wound. It was not tender and presented none of the signs of inflammation except a slight sense of fluctuation. A small incision was made into the mass, and about a half dram of a greyish gelatinous substance was obtained. Under the microscope this substance was found to be necrotic tissue. No evidence of a suture could be found, and nothing resembling any part of an adult filaria was seen. The wound was dressed twice daily for six days, at the end of which time only a slight granulating area remained, and the patient returned to South America.

Word occasionally received from Dr. Le Franc informs me

that the patient has had no return of his symptoms, and that the embryos remain absent from the blood. On September 27, 1905, Dr. Le Franc stated that the patient had become the father of a child and that he had expressed himself as being much improved sexually since the operation.

In a letter received from the patient himself in January, 1906, twenty months after operation, he states that he considers himself entirely cured of his trouble.

The Specimen.—The mass of tissue removed from the ***right side*** is 24 cm. long. The lower end shows several small vessels cut across. The diameter at this point is 2 cm. The upper end, similar in structure, measures 2 cm. in diameter. From both ends the mass increases in size and the central point is ovoid in shape. This enlarged area measures 12 cm. x 6 cm. x 3 cm., and is made up of tortuous vessels from 1 to 5 mm. in diameter, resembling a varicocele. These vessels are surrounded by loose areolar tissue. The contents of these vessels is chylous.

The specimen from the ***left side*** is 21 cm. long and 4 cm. at its greatest width. Like the specimen of the right side, it consists of tortuous lymphatic vessels and areolar tissue, and two of the vessels can be traced the entire length of the mass. They measure 7mm. in diameter, and the walls are 1 mm. in thickness.

The tissue was placed in normal salt solution and kept in a thermostat for several hours, but the worms did not appear.

The two masses of tissue were examined microscopically by Dr. S. B. Wolbach, of the Harvard Medical School. The tissue was divided into slices, about 1 cm. thick. Every other slice was embedded in celloidin, and stained with hæmatoxylin and eosin. Twenty-eight blocks in all were examined.

The microscopic sections consisted of loose connective and fat tissue, with many thick-walled arteries and veins, some of which are obliterated by connective tissue. There is a marked lymphoid and plasma-cell infiltration in the connective tissue surrounding the capillaries and veins. There are numerous dilated lymphatics in the fat and perivascular tissue. There is a slight general infiltration of the connective tissue with lymphoid and plasma cells. No filariæ were found in the tissue examined.

It has been suggested by Dr. Wolbach that the worms may have escaped with the chyle which was emptied from the lymphatic directly after the operation.

History.—Certain manifestations due to the filaria sanguinis hominis received the attention of Arabian medical men as far back as the ninth and tenth centuries. The chief manifestation of which we have record was elephantiasis, which is the Greek translation of the words Da-al fil, meaning elephantine disease.

Chapotin, in 1812, had recognized endemic hæmatochyluria and communicated his knowledge in writing to Mauritius.

Nothing was known of the etiological factor producing these various manifestations until 1863, when Demarquay, in Paris, first discovered the filaria nocturna in a chylous fluid obtained by tapping a hydrocele in a young man, a native of Havana.

In 1868, Wucherer, in Bahia, Brazil, found filarial embryos in chylous urine.

In 1868, Lewis, in Calcutta, also observed filarial embryos in chylous urine, and demonstrated them in the blood of a patient with chronic diarrhœa. He subsequently found the parasites in the blood and lymphatic secretions of individuals with elephantiasis of the legs and scrotum, and in the blood of persons presenting the symptom hæmaturia, and considered the parasite to be the cause of these various manifestations. Lewis demonstrated the filaria without any knowledge of the previous discoveries, and gave the hæmatozoon the name of *filaria sanguinis hominis.*

It had been observed that the filari did not grow to the adult worm in the human body. In 1878 Manson discovered that the mosquito was the intermediate host in which the embryo matured to the adult worm and then invaded man anew. He found that the filaria embryos were ingested with the blood by the female mosquito (the male having no sting), and were developed in the stomach. Some of the embryos were digested, others slipped from their sheaths and bored through the walls of the stomach, invading the muscles of the thorax, undergoing a metamorphosis, requiring two or three weeks until they were transformed into an actively mobile

worm. He believed that matured eggs were deposited in stagnant water and that the filaria entered the human body in drinking water.

Bancroft found that the larvæ could not live in water, dying in from three to four days. His idea was that infection occurred by swallowing mosquitoes containing larvæ while asleep, with food, or the mosquito being killed, the filaria was transferred to the mouth by means of the fingers. He also believed in the transmission of the disease through the sting of mosquitoes.

Myers, to determine the truth of Manson's idea, fed monkeys with water in which mosquitoes fed upon the blood of filarial patients had laid their eggs. The results were negative.

Vincent, in 1895, proved by careful experiments that when the mosquito falls into the water, the filariæ, if unable to escape, die in twenty-four hours by imbibition, and in another series proves that the filaria does not pass from the living mosquito in the act of suction of water.

Lewis confirmed Manson's observations that the filaria larvæ pierced the walls of the mosquito's stomach and experienced developmental changes in the abdominal and thoracic tissue. Low demonstrated that the filariæ migrated to the head and proboscis of the mosquito and inferred that the parasite enters human tissue when the insect stings an individual.

Manson deserves the credit for our knowledge of the *life history and periodicity* of the parasite. He demonstrated that the embryos were present in the peripheral circulation during the night, and considered this periodicity to be an adaptation to the habits of the mosquito.

Mackenzie pointed out that if the patient slept by day and worked by night the habit of the filariæ reversed and they were present in the peripheral circulation during the day and not during the night. His observations were made by examining the blood every three hours during the day and night for a period of ten weeks.

The periodicity cannot depend entirely upon the sleeping state, as the embryos can be demonstrated between five and six

o'clock or several hours before the patient retires. The number in the peripheral circulation increases, reaching a maximum about midnight, when from 300 to 600 are found in every drop of blood, which, assuming that the parasites are evenly distributed throughout the circulation, shows that there are from forty to fifty millions in the circulation at that time. The number gradually decreases from midnight, and they usually disappear entirely by eight or nine o'clock in the morning.

It is evident, therefore, that the sleeping state is not the cause *per se* of the increase in the number of parasites in circulation. The ingress begins several hours before the usual time for sleep and the egress is not complete until several hours after the usual time for waking. Further study may reveal a reasonable explanation for filarial periodicity.

In 1899 Manson demonstrated that when the filariæ are absent from the peripheral circulation they may be found in the larger blood-vessels of the lungs, and less frequently elsewhere. His observation was made upon a patient suffering from lymphscrotum and varicose inguinal nodes. This patient committed suicide in the morning by swallowing hydrocyanic acid, death occurring almost instantly. A post-mortem examination six hours later revealed a large lymphatic varix occupying the pelvis and the back part of the abdominal cavity. In this varix, adult filariæ Bancrofti were found. The embryos were noted to be most numerous in the large blood-vessels and in the lungs. They were also found in the liver, spleen, and heart muscles.

The Adult Filariæ Bancrofti.—The adult filaria Bancrofti belongs to the nematodes, and was first discovered by Bancroft, of Brisbane, Australia, in 1876, in a lymphatic abscess on a patient's arm. In 1877 Cobbold published the fact and named the nematode the filaria Bancrofti.

The adult filaria, first found by Bancroft in 1878, has since been found by various observers. The adult filaria, however, has been found only in a very small percentage of the cases suffering from filariasis. In 1877 Lewis found a portion of a male and female worm in a blood-clot from a

lymphscrotum, after searching eight hours. In 1877 Des Santos, in Brazil, found five adult females in a lymphatic abscess of the arm. In 1881 Manson found a few fragments of a female worm in an abscess of the thigh, and in the same year demonstrated a female filaria in the dilated lymphatic in a case of lymphscrotum. In 1888 Sibthorpe of Madras, India, found two worms, a male and a female, on the cut surface of a lymphscrotum. In 1894 Maitland, of Madras, India, obtained eight adult worms in lymphatic tissue removed from the inner surface of the upper arm in two operations; three were males and five females. Huber states that Czerny found a living female filaria in the ovary of a woman from Rio Janeiro. In 1897 Young, in London, removed a hard, nodular mass from a sailor, a native of Jamaica, who suffered from lymphscrotum, and varicose groin glands. This man committed suicide, and at autopsy the right varicose groin-glands were found to contain three female filaria Bancrofti. In the lymphatics of the right spermatic cord six more adult female worms were found. In the left spermatic cord seven worms were found, one being a male. In 1890 Lothrop and Pratt found nine worms, two males and seven females, in the lymphatics of the epididymis, following castration for filariasis. In 1903 Opie found an adult worm in the right epididymis, at autopsy. Primrose, in 1903, obtained an adult filaria and several fragments in an operation for lymphscrotum.

Taniguchi records four cases in which the adult worms were found. One case was a male suffering from inguinal lymphvarices. Two adult worms were recovered at operation. His other case was a woman who had several small nodes in the breast. At operation several adult filariæ Bancrofti were found. The remaining two cases recorded by Taniguchi belonged, one to Ikeda, and the other to Kumono. Both these cases were operated upon for inguinal lymphvarices and lymphscrotum and the worms were found in each instance. The number and sexes are not recorded.

It is seen, from the above, that the female is much more commonly found than the male worm, and that the location

in fifteen out of the nineteen cases was in relation to some part of the generative system: Lymphscrotum (Lewis, Manson, Bibthorpe, Primrose, Taniguchi, Ikeda, Kumono), chylocele fluid (Bancroft), epididymis (Lothrop and Pratt, Opie), ovary (Czerny), spermatic cord (Young), arm (Bancroft, Maitland, Young, and dos Santos), leg (Manson), breast (Taniguchi).

The adult parental forms of the filaria Bancrofti are long, hair-like, transparent nematodes, from three to four inches in length. The male and female are often found coiled about one another, within dilated lymphatics and the lymphatic glands themselves.

The female is considerably larger than the male, and measures from 8.5 to 9.5 cm. in length, and is the thickness of a human hair. Macroscopically the worm is a small, slender, delicate, whitish, hair-like body. Microscopically the head is rounded, with an unprotected oral orifice. The tail, which is slightly tapering, has an abrupt end. The anal aperture is situated just in front of the termination of the tail, while the sexual openings are near the head. The digestive tract is a simple tube, and the remainder of the body is occupied by the sexual organs. Manson states that the worm is normally viviparous, but that the eggs are sometimes prematurely deposited so that it becomes oviparous.

The male worm is shorter and slenderer and has a marked disposition to curl. Daniels gives his length as 4.4 cm. Manson describes two slender unequal spicules originating at the cloaca.

Embryos.—The embryos are found in the peripheral circulation as delicate, translucent, smooth, almost cylindrical bodies. The head end is rounded and the caudal extremity is pointed. Scheube states the average length to be 0.216 mm. and the breadth 0.004 mm. The parasite is enveloped in a transparent sheath which is longer than the embryo, and which is sometimes seen trailing after the head or tail, or both. The embryo has been observed to move about within its sheath. When studied in freshly-drawn blood the movements are con-

tinuous, but not those of progression. The tail whips from side to side actively amongst the blood corpuscles. It writhes and coils with much activity. The embryos remain alive for several days if the preparation is prevented from disintegration.

Under high magnification there is an irregular granular mass observed at the posterior part of the middle third of the parasite, and a very delicate transverse striation can be detected throughout the entire length of the embryo. By staining with a mild solution of hæmatoxylin Manson has demonstrated a V-shaped patch at a point of about one-fifth the entire length of the organism, backward from the head end, and a similar spot, though smaller, situated a short distance from the end of the tail. The former of these he terms the "V spot" and the latter the "tail spot," and considers them to be connected with development, the anterior one being the future water vascular system, or generative organs, and the posterior one for the anus or cloaca. Manson has also found in filarial embryos whose movements have almost ceased that the head is constantly being uncovered from a very delicate prepuce, and can sometimes demonstrate that a short fang is shot out and retracted from the center of the head.

The Life History of the Filaria Nocturna.—The mosquito is the intermediate host, and man the definite host. Female mosquitoes of the genus *Culex* (*C. fatigans*), and, according to James, *Anopheles* (*A. niggorimus*), draw the filarial embryos from the infested individual. The parasites find their way to the stomach, where they escape from their sheaths, which they leave behind. They penetrate the stomach and enter the thoracic muscles of the insect, where they undergo a metamorphosis, which, according to Manson, requires from sixteen to twenty days to complete. The embryo is then transformed into a worm a sixteenth of an inch long, with the activity of the young parasite. A mouth and alimentary canal, and a trilobod tail, may be distinguished. Less often these larval forms may be demonstrated in the abdomen as well as in the thorax. When this metamorphosis has taken place the majority pass forward by the prothorax and neck of the mos-

quito, and, as Low has pointed out, enter the proboscis. This observation has also been confirmed by Manson, Annette, Dutton, and James. Manson states that in all the sections of this region which he has examined he has found two worms together in each instance. The parasite remains in this position until the mosquito feeds upon some warm-blooded vertebrate, at which time the parasite enters the definitive host. Bancroft found that filarial infested mosquitoes, fed upon bananas or other vegetable substances, do not part with the filariæ situated in their probosces.

After entering the human body the filaria finds its way into the lymphatic system, where it remains and develops into the mature parent worm.

Pathological Changes Produced by the Presence of the Filaria Nocturna.—The presence of filaria in the human body does not always give rise to manifestations. In the majority of individuals afflicted, ill effects are produced by the obstruction of the lymphatics, and the greater proportion of such manifestations are associated with the generative and urinary systems; and furthermore, the parent worm is most often here located.

It is not known that the parent filaria lives elsewhere than in the lymphatic vessels in the human body, nor is there evidence that they migrate from one part of the body to another. It is not known how long the parent worms may remain alive, and persons living in filarial districts are probably infected many times.

No pathological changes are produced by the embryos, so far as is known. The parent worms, on the other hand, produce obstruction directly or indirectly in the lymphatic circulation. While it is rare that the worms produce occlusion of a lymph-channel, their presence results in secondary changes, thickening the lymphatic walls and narrowing their lumina. Moreover, the location of the parent worm is not infrequently the seat of infection, producing abscess and lymphangitis, which further changes the structure of the lymphatic channels. Manson states that the ova are capable

of obstructing the smaller lymphatics and statis may be thus produced.

By thrombosing lmyphatic channels there is a rise of lymph pressure in the occluded vessels resulting in varicosities and lymphatic œdema. As an effect a compensatory circulation is established.

Local Manifestations.—Great variation of the disease filariasis is displayed, dependent upon an engorgement of the lymphatics distal to the point of occlusion.

Flynn records fifty cases of filariasis, the clinical evidence occurring as follows: *Chyluria,* 9, 8 being males (one showed a palpable varicose condition of the prostate); *elephantiasis,* 7, 6 being females; *lymphscrotum,* 5; *chylous hydrocele,* 12; *intermittent orchitis,* 4; *varicose groin glands,* 13, all bilateral, and all in males.

The following changes are well recognized occurring singly or existing together: (1) Dilated lymph-vessels,—*lymphatic varix, lymphangiectasis*; (2) dilated lymph-glands,—*varicose glands*; (3) cutaneous lymphatic obstruction occurring as œdema,—*lymphscrotum, lymphvulva,* and *elephantiasis Arabum*; (4) rupture of dilated varices, producing chyluria, chylous hydrocele, chylous ascites, or chylous diarrhœa, according to the organ into which the rupture takes place; (5) manifestations produced by secondary pyogenic infection,—lymphangitis, cellulitis and abscess.

Dilated Lymph-Vessels. Lymphatic varix—lymphangiectasis.—By occlusion of the lymphatic channels there is a rise of lymph-pressure; the lymphatics distal to the obstruction become dilated, and a compensatory circulation is soon established, resulting in the formation of a lymphatic varix, varying in degree according to the amount of obstruction. The site of the obstruction, of course, varies the location of the varix. When the obstruction is in the thoracic duct, the chyle can only reach the circulation by a retrograde flow through the lymphatics of the groin, scrotum, pelvis, and abdomen. Dilatation therefore takes place in all the lymphatic vessels below the point of obstruction in the thoracic duct. Manson depicts a

case of Mackenzie's in which the abdominal and pelvic lymphatics formed a varix about a foot in diameter, concealing the kidneys, bladder and spermatic cords.

Opie reports the autopsy upon a case of filaria sanguinis hominis in which a plexus of enormously dilated lymphatic vessels was situated in the abdomen and pelvis, in front of the vertebral column. The plexus was continued along the whole course of the thoracic duct. From the plexus lymph varices extended along both spermatic veins as far as the epididymis, and a similar mass of dilated lymphatics was continuous along the course of the femoral artery and vein, and formed a mass in the groin. This mass was mistaken for a hernia at the patient's entrance to the Johns Hopkins Hospital, and was cut down upon, but not removed. The diagnosis of the true condition was not made until after death. Brodel's drawing of this case is the best illustration in literature.

Dilated Lymph-Glands (*varicose glands*).—It is unusual to observe varicose glands elsewhere than in the groins and femoral regions. Dilated lymphatic vessels can usually be demonstrated running to and from the nodes. The increase in size of the nodes is slow and usually without symptoms and they often attain a considerable size before they attract the patient's attention.

Upon inspection they resemble herniæ and unless they have been the seat of inflammation the skin is freely movable, the mass is soft, doughy, not tender, with an ill-defined outline. They decrease in size while the patient is in a recumbent position, and slowly enlarge when he is erect. The absence of impulse upon cough, tympany on percussion, and the demonstration of a normal sized external ring, may be the only features distinguishing it from inguinal hernia; and when situated in the femoral region the diagnosis is less easy.

The adult worms may have their seat somewhere in the thoracic duct, and the varicosities may be but a part of lymph varices existing in the abdomen and pelvis, as in Opie's case. On the other hand, the parasites may be situated in the groin-glands themselves. If a chylous fluid is obtained when the

lymph-glands are tapped, the obstruction is probably in the thoracic duct, but if the fluid is not milky, but clear, the parasite is probably contained within the mass.

Cutaneous Lymphatic Obstruction Occurring as Œdema.—*Lymphscrotum* results from obstruction in the lymphatics of the skin and is usually accompanied by dilated lymph-glands. Small varices may appear on the scrotal integument. These sometimes rupture with the escape of lymph. Inflammation is prone to occur and ulcerations, cellulitis, or abscess formations may develop in the deeper layers of the skin, while eczema is often encountered upon the surface.

Lymphvulva does not differ in any way from lymphscrotum.

Elephantiasis Arabum.—There has been some dispute as to whether this condition is a manifestation of filariasis. Manson, however, has recently presented evidence in support of this theory. This affection does not, however, concern us.

Rupture of Dilated Varices, producing *chyluria, chylous hydrocele, chylous ascites,* or *chylous diarrhœa.*—In the condition cited the parasites are probably located in the thoracic duct, or one of its affluents, or in the tissues about the abdominal aorta. Engorgement and a retrograde current in the dilated vessels results. The pressure within the vessels may be sufficient to cause them to burst. The viscus into which the rupture takes place becomes the site for the collection of the chylous fluid. If this occurs anywhere along the urinary tract a mixture of urine and chyle results. If the rupture takes place into the tunica vaginalis, it results in chylous hydrocele, or chylocele; the abdominal cavity, chylous ascites; and into the bowel, chylous diarrhœa.

Chyluria.—Although the presence of chylous urine comes on suddenly it is the commonest external manifestation of filariasis. The rupture of the dilated lymph-channel may take place anywhere along the urinary tract, most commonly in the bladder and kidney. The urine contains, besides its normal constituents, chyle and lymph. The color of the urine varies with the process of digestion. It is usually milk-white soon

after digestion has commenced, on account of the excess of fats. Because of the presence of the lymphatic contents when the process of digestion is not active, the urine is turbid when voided, and soon separated into three or more distinct layers.

Hæmorrhage may be associated with chyluria, when the condition is spoken of as *hæmatochyluria.* It is believed by some that the sanguinous character of the urine in *hæmatochyluria,* is due to the rupture of the blood-vessels at a point near the place of rupture of the lymphatic vessels. Manson, however, attributes the presence of blood in the urine, in such cases, to the formation of blood-corpuscles in the lymph contained within the varicose vessels.

The urine may suddenly become normal in color, probably from a closure of the fistula. There is a tendency for chyluria to recur, and Lancereaux records a case where it was persistent for fifty years.

Chyluria is found to occur after childbirth, or violent effort in those suffering from filariasis.

The site of the filaria Bancrofti in this condition has never been absolutely demonstrated. Ponfick and Havellburg each record a post-mortem, and Mackenzie has had two cases which came to autopsy, and in no instance were the parent worms found. Pain in the back is usually present, from the greatly distended lymph-varix within the abdominal cavity.

Retention of urine sometimes results by chylous coagulation in the bladder and is not infrequently the first indication of trouble in the urinary system.

Flynn has demonstrated a positive Widal reaction in one case. The test has not been applied to any other cases, so far as I am aware.

Chylous hydrocele is the result of chyle being poured out in the tunica vaginalis. In the case reported by Lothrop and Pratt the dilated lymphatics of the spermatic cord were excised. This prevented the normal return of lymph from the testes and an accumulation of chylous fluid resulted in the tunica vaginalis.

A chylous hydrocele presents the ordinary physical signs

of a serous hydrocele except that the translucency is diminished. The parent worms are usually situated in the region of the testicles.

Manson, recording sixty-two cases of filariasis, found six cases of chylous hydrocele. Flynn records twelve cases in a series of fifty, and has demonstrated quantities of cholesterin crystals in the fluid drawn from the tunica vaginalis. Embryos have been demonstrated in chylocele fluid by many.

Chylous ascites is dependent upon the escape of chyle from the abdominal lymphatics into the peritoneal cavity.

Chylous diarrhœa is the result of the emptying of the dilated lymphatic vessel into the intestinal canal.

(5) *Manifestations Produced by Secondary Pyogenic Infection. Abscess, lymphangitis* and *cellulitis.*—Whether or not on account of injury to the lymphatics by a blow or otherwise, the parent filaria sometimes dies, and acts as an irritant, producing inflammation, often resulting in abscess, in the contents of which fragments of the dead filaria have been found.

If the inflammation is within the abdomen the general abdominal symptoms dependent upon inflammation are evident.

Lymphangitis and *cellulitis* occur commonly in all forms of filarial disease, particularly in varicose glands, lymphscrotum, and elephantiasis. The lymphatic-trunks become cord-like, reddened, hot, and painful. The adjacent tissue and skin become inflamed and tense, and constitutional symptoms, ushered in by a prolonged rigor, with subsequent fever, continue for several days. Delirium and death may result. Usually, however, the attack is relieved by a discharge of lymph upon the surface of the skin, and a profuse general diaphoresis. This condition is spoken of as "elephantoid fever."

The Blood.—Filarial disease seems to exert little influence upon the red corpuscles or hæmoglobin. The white cells are however increased in number and there is a relatively high percentage of eosinophiles.

Gullard records a case in which the leucocytosis varied

from 4,600 to 13,500, and the eosinophiles between 3 and 12 per cent. In this case there was a constantly high proportion of lymphocytes, as well as eosinophiles, and the polynuclear forms never reached the normal minimum of 70 per cent. The most interesting point about Gullard's case is that the percentage of eosinophiles rose from a normal figure in the morning, when no filarial embryos were present, to a high percentage just before midnight, when a large number of embryos were in circulation.

Calvert found a leucocytosis and eosinophilia in two Filipino prisoners. He showed also that the percentage of lymphocytes was fairly high, and believes that filariasis, like trichinosis and akylostomiasis, has a positive chemiotaxis for eosinophiles, and that whenever the parasite is in the body there is an eosinophilia.

In one of Calvert's cases the leucocytosis reached 26,666, and in the other 14,000. The eosinophilia in the first case varied from 8. to 22., and in the second from 3. to 20.5.

He found the leucocytosis and eosinophilia to be most marked during the daytime, that is, when the embryos were not in the peripheral circulation.

Wherry and McDill found an eosinophilia varying from 6.0 to 10.0 in the morning, and 12.0 at midnight. Unlike Calvert's observations, they found the eosinophiles to be most numerous when the embryos occupied the peripheral circulation in the greatest numbers.

Wurtz and Clerc record an eosinophilia of 38.0, and in Lothrop's and Pratt's case the eosinophiles varied from 3.5 to 4.6.

Remlinger and Menchen Hodara-Bey record two cases of chyluria occurring in Egyptians. In these cases the eosinophilia was very high; in the first case 70.0, and in the second 75.0. They noted certain morphological changes in the eosinophiles. Each eosinophile presented very marked granulation in the protoplasm. Some leucocytes were observed, in which the granular material was outside of the cell, as though the cell-capsule had ruptured. They feel that the phagocytic

property of the leucocytes is diminished by this granular invasion and disintegration of the cells; and on this account suppurative processes are so common in filarial patients.

In the writer's case the blood observations show an increased number of leucocytes during the time at which the filarial embryos are in the peripheral circulation, and also a relatively high number of eosinophiles at this time. These observations are in accord with those of Gullard and those of Wherry and McDill. The lymphocytes remained constantly high, and were increased with the eosinophiles. There was little change in the mononuclear leucocytes from normal, but the polynuclears were decreased at all times. The eosinophilia, although slightly increased during the day, rose to a maximum at the time when the embryos were most numerous, reaching 20.5.

Following operation the red cells and hæmoglobin remained unchanged. The white cells showed no increase. The differential count showed that the lymphocytes had dropped almost to normal; that the mononuclear cells were normal, and that the polynuclears had risen and the eosinophiles fallen almost to normal percentages.

Prophylaxis.—There seems to be no doubt that filariasis is transmitted through the mosquito; therefore, any prophylactic measures against infection must depend upon protection from mosquitoes.

By special conditions for breeding the *Anopheles* may be annihilated from a locality. The *Culices* breed more readily, and select any collection of water for this purpose.

The protection of stored water from the insects and the frequent emptying of vessels containing water, so as not to allow sufficient time for larvæ to mature, and employing only that water which is freshly filtered, are the only means for the prevention of infection from this source. Mosquito-nets should be worn as a safeguard when in filarial districts. Individuals infected with filariæ are a constant source of danger to the community.

Treatment.—So far as is known, the embryos are not

harmful, and the treatment is therefore directed toward killing or removing the parent worm.

Medical Treatment.—Numerous drugs have been employed in attempting to cure filarial disease. Flint recommends methylene blue, 0.12 every four hours, and believes that he cured a case of chyluria by this means. Zellweger claims to have produced good results in five cases of lymph scrotum and chyluria with this drug, while Henry found methylene blue absolutely inefficacious. Thymol, benzoic acid, benzoate of soda, and boric acid have also been supposed to have a beneficial effect. Scheube claims to have killed the parasite by administering picric-nitrate of potash.

The most commonly employed drug is quinine, and although weak solutions will kill the embryo outside of the body, it seems to have no effect whatever upon them while in the circulation.

Recently Wherry and McDill exposed the back of a patient suffering with hæmatochyluria to the "X-rays." After the exposure the embryos were found to be in no way affected.

In hæmatochyluria some relief of symptoms has been gained by bladder irrigation with mercurial chloride, 1–10,000, boric acid, and other solutions of mild antiseptics. When the bleeding is considerable adrenalin chloride has been injected into the bladder, and given by mouth, with good results.

Medical treatment must be considered to be of use only to palliate the symptoms arising as manifestations of the disease itself.

Operative Treatment to be anything more than symptomatic and palliative must be directed toward removing the parent worm. The thoracic duct, pelvic and abdominal lymphatics are not readily accessible, and when the parent filariæ are here situated the only form of treatment that can be employed is absolute rest, with the hips elevated to reduce the hydrostatic pressure, and a light diet with restricted fats. Diuretics and cathartics are of value in reducing the tension within the lymphatics.

However, even if the adult worms are so situated and the lymph stasis has produced dilated lymph-glands, lymph scrotum, chylocele, or other external evidences of the disease which are annoying to the patient, operative treatment, as a palliative measure, has been followed by marked beneficial results. If, on the other hand, the local condition harbors the parent filaria, an operation removing the lymph-vessels, and the adult filariæ Bancrofti, will be curative.

Three distinct objections have been put forth against operation for the removal of lymphatic varices, and lymph adenoceles: First, that such operations are unscientific in principle, because only a portion of the varix is removed and the obstruction in the lymph circulation still remains. Second, that persistent lymphorrhagia and lymphatic fistulæ follow. Third, that such operations are liable to result in septic infection or erysipelas.

Operative experience has shown, however, that the varices are often local and can be entirely removed; that the patient may be cured of his symptoms even though the parent worms are not demonstrated in the excised mass; and that when the parent filariæ themselves are removed the patient is truly cured.

Maitland, who has had considerable operative experience with this disease, and who is familiar with the experiences of other surgeons in Madras and elsewhere, states that he has never known or heard of a lymphorrhagia or lymphatic fistula resulting from operation. Maitland states also that he has not seen or heard of a fatality by septic inflammation or erysipelas resulting from operation. He further states that a tight dressing placed over the wound causes the lymphatic channel to become sealed, and oozing does not take place in a greater degree than would from any operation wound.

Experience has proven that the suffering produced by the constantly recurring attacks of pain, erysipeloid inflammations and constitutional symptoms, has been relieved by removing varices which are accessible.

Following are brief outlines of the cases which have been operated upon:

PRIMROSE records a case of a man suffering from filariasis, upon whom he operated for lymphscrotum. In the excised tissue an adult filaria and several fragments were found. Twenty-four days after operation embryos were abundant in the blood; which showed that all the adult filariæ had not been removed. Forty-six days later the patient had an attack of lymphangitis in the neck. A circumscribed swelling developed, which was opened ten days later and sloughing tissue was removed. No adult worm was detected. Sixty-seven days after the second operation all embryos had disappeared from the blood.

MANSON expressed the opinion regarding this case that the first operation upon the lymphscrotum was not the one which cured the patient, but that the lymphangitis in the neck was probably the site of the remaining parent worm.

MR. H. J. STILES operated upon varicose groin-glands in a case in which Gullard studied the blood. No mention, however, as to the final outcome was made.

BROWN operated upon a case in which there was a straw-colored fluid in the tunica vaginalis. The testicle and the lower third of the vas deferens were removed. A small nodule was found situated in the testicle just under the epididymis. It had a compact fibrous periphery, and in the center was a yellowish-white, semi-fluid material. Smears were stained for tubercle bacilli, but none were found; instead, however, larvæ of the filaria sanguinis hominis were discovered.

MAITLAND reports three cases upon which he has operated with good results. First, a case of lymph-gland of the right groin. The entire mass was removed. The patient had remained well at a period four years after operation. Second, the case was of an individual with a large lymphatic varix in the right femoral region. The result nine years after operation was entirely satisfactory, and Maitland quotes portions of the patient's testimony, one sentence of which is as follows: "It is beyond description to write of the benefit of the operation," Nine years after the operation the patient was again attacked by the disease, the lymphatic obstruction being in the inter-abdominal vessels. The third case was one with a large lymphatic varix in the right groin, and a smaller one in the left groin. The mass in the right groin was removed, and suppuration occurred in the wound. One month after operation no filariæ could be demonstrated in the blood. The year of this operation was 1894. Maitland's report was in 1902, and in that time, he stated, the patient had remained well, and the varices in the left groin had caused no trouble.

FLYNN removed a varicose tumor of the left spermatic cord, leaving the testicle and vas deferens. The parent worms were not found, but the embryos disappeared from the blood, and it is believed that they must have escaped detection in the mass. Flynn has done partial excisions of the tunica vaginalis in five patients, and, as he expresses it "each patient considers himself cured."

LOTHROP removed a varicose spermatic cord, together with the

testicle and tunica vaginalis. Nine parent worms were found, and although filarial embryos were persistent in the blood the patient was relieved of his symptoms.

GODLEE, following the suggestion of Manson, cut down upon a lymph varix in the right groin, and anastomosed a dilated lymphatic vessel with a tributary of the internal saphenous vein. The result was that the lower part of the swelling disappeared. The upper part remained, however, and a month later he anastomosed one of the dilated lymphatic vessels of the cord with one of the spermatic veins. The swelling disappeared and has remained so. Manson and Godlee believe that the obstruction to the thoracic duct was opposite the lymphatics accompanying the spermatic vessels, and that although the obstruction still remains there is no regurgitation of chyle.

GODLEE operated upon another case with large swellings in both groins. the swelling in the right groin was exposed, and one of the lymphatics anastomosed with a vein. At a second operation the swelling in the left groin was exposed, partially removed, and a lymphatic was anastomosed with a tributary of the internal saphenous vein. A portion of the tumor in the right thigh was removed at the same time. There was considerable oozing of chyle and lymph subsequently, but the wound healed rapidly. The improvement was not so marked as in his previous case.

The cases of filariasis treated surgically are comparatively few. The relatively large number treated medically, and the little benefit so obtained, leads one to hope that more cases may receive surgical treatment. Even though the parent worms are not found, as in the writer's case, they may be retained within the diseased mass and escape detection, the embryos disappearing from the blood, and the individual remaining free from his symptoms.

On the other hand, when the parent filariæ are known to be left alleviation of the symptoms has followed by overcoming the stasis and regurgitation of chyle.

It is not without interest to note that there are five cases which committed suicide while under observation, and that another attempted suicide, but failed.

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THE RADICAL CURE OF FEMORAL HERNIA.*

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BETWEEN the years 1891 and 1906 I performed 117 operations for femoral hernia in 105 patients. In thirty-four of these operations the patients were children between the ages of two and fourteen years. Nine were males and eighteen females. In 3 operations the patients were under five years of age; in 15 operations the patients were from five to ten years of age; in 14 operations the patients were from ten to fourteen years of age.

Eighty-three operations were done upon adults, or patients between fourteen and seventy years of age. Of these patients twelve were males, sixty-five females.

It will be seen that in children the relative frequency of femoral hernia in males to females is one to two, while in adults it is about one to six.

The relative frequency of femoral hernia to inguinal hernia, as given by Macready (Statistics of the London Truss Ass'n) is one to 16.

At the Hospital for Ruptured and Crippled it is one to 17.

The fifteen thousand and twenty-eight cases of inguinal and femoral hernia operated upon for radical cure at various clinics and by various surgeons, collected by Pott,[1] show 933 operations for femoral and 14,092 operations for inguinal hernia, or a proportion of one femoral to fifteen inguinal.

My own operative statistic for the radical cure of hernia shows almost exactly the same percentage, namely, 117 fem-

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orals in a total of 1,678 cases, or one operation for femoral to fourteen for inguinal hernia.

Previous statistics have almost uniformly given a slightly higher mortality in operations for femoral than for inguinal hernia, and also a smaller percentage of permanent cures. Unfortunately, there have been very few reports of any large series of operations for femoral hernia, and still fewer reports of cases traced for any length of time.

The careful analysis of Pott [2] of 933 cases of femoral hernia operated upon prior to 1903, shows that the results of operation for radical cure in femoral hernia have been distinctly inferior to those in inguinal, the percentage of permanent cures in inguinal hernia being 82 per cent. and in femoral 70.5 per cent.

He further shows that the results were much better when the femoral canal was closed than when the sac was simply excised and the wound closed without suture of the canal; the results being 63.3 per cent. of cures without suture, and 76.4 per cent. with suture.

A very large number of methods have been proposed and many of these are still in vogue; however, more by reason of the fact that they were devised by some distinguished surgeon, than by the fact that practical experience has demonstrated their value.

The hope of supplying some of the data necessary for determining the relative merits of different operations for femoral hernia, is excuse for the present paper.

The earlier operations consisted in simple excision of the sac without any attempt to close the canal. In such operations there was usually a recurrence within a year in 30 to 40 per cent. of the cases.

In 1890 Dr. Wm. T. Bull [3] reported thirteen cases of femoral hernia operated upon by this method, eight of which were traced beyond a year, with three relapses. In 1889 and 1890 Cushing and Marcy published a form of purse string suture of the femoral ring and called it a " quilted " suture.

In later methods of operation, in addition to ligating the sac, an attempt was made to close the femoral canal. These methods may be divided into two main groups, *i.e.:*

1. Those in which an effort was made to close the canal by means of a suture applied in a great variety of ways;

2. Those in which it was attempted to close the canal by means of muscle, osteoplastic or heteroplastic flaps.

The suture methods may also be divided in two groups: (*a*) suture of external ring; (*b*) suture of internal ring.

Some of the methods of suturing the canal are exceedingly complicated, *e.g.*, the Lotheissen and the Gordon operations, 1898, and more recently those devised by Roux and Nicoll. The reasons advanced by the authors in favor of adopting these more difficult and complicated procedures for the cure of femoral hernia are all based on the supposition that femoral hernia is not readily curable by simpler methods. With this opinion I strongly desire to take issue.

The first paper of note going far to prove that almost perfect results can be obtained with simpler methods, was that of Bassini,[4] who, in describing his own method for the radical cure of femoral hernia, reported fifty-four cases operated upon by the same, of which forty-one had been traced from one to nine years, without a single relapse.

The technique of Bassini's operation was exceedingly simple and easy of performance, consisting in high ligation of the sac and uniting the roof of the canal with the pectineal fascia and muscle by means of seven interrupted sutures.

A recent paper by De Garmo, reporting 110 operations for femoral hernia by a method similar to Bassini's, with but one relapse, furnishes additional proof of the strongest kind of the value of the simpler methods.

In my own cases, two methods only have been employed:

1. *Bassini's Method,* which was used in fifteen cases, with one relapse, the only variation being the substitution of kangaroo tendon for silk used by Bassini. The case in which a relapse occurred was the only one in which there was suppu-

ration, and to this fact the relapse may be attributed. The relapse consisted, however, only in a slight bulging of the canal, which disappeared after the use of a truss for a short time, and the patient is now well, ten years after operation. It can, therefore, hardly be classed as a true recurrence.

2. *The Purse String Suture Method,* which has been employed in 103 cases. It is based upon an operation devised by Cushing of Boston, in 1888, but differing from it somewhat in technique. The operation may be briefly described as follows:

An oblique incision is made one-quarter to one-half inch below Poupart's ligament and parallel with it, almost identical with the incision made for inguinal hernia, only slightly lower and a little shorter. The sac with the mass of extra-peritoneal fat that almost always surrounds it is then freed well up into the femoral opening. The masses of fat are carefully removed, the sac itself, by gentle traction, is brought down well beyond its neck to a point where it widens into the general peritoneal cavity. It is always opened before ligature, so make sure that it is empty. If omentum is present, this is tied off and removed. The ligature having been placed well beyond the neck by transfixion, it is carefully tied and the sac removed. When the stump of the sac has been pushed through the opening into the abdominal cavity, there is no longer any funicular process present in the femoral region. With a curved Hagedorn needle,[5] threaded with kangaroo tendon of medium size, the suture is placed as follows: The needle is first passed through the inner portion of Poupart's ligament or the roof of the canal, then downward, taking firm hold of the pectineal fascia and muscle, then outwards through the fascia lata overlying the femoral vein, and finally upwards, emerging through the roof of the canal about one-quarter inch distant from the point of entrance (Fig. 1.) On tying this suture, the floor of the canal is brought into apposition with the roof, and the femoral opening is completely obliterated. The skin and superficial fascia are closed by means of an inter-

FIG. 1.—Obliteration of the femoral opening by purse-string suture.

rupted catgut suture and a sterile dressing is applied, without drainage. The first change of dressing is made at the end of one week. The patient is kept in bed for two weeks and allowed to go home at the end of two and a half weeks. A firm spica bandage is worn one week after leaving the hospital, at the end of which time no further support is needed.

The purse-string suture thus applied accomplishes exactly the same thing as Bassini's operation for femoral hernia, and it has the advantage that it is much more easily and quickly performed.

In the 100 cases operated upon by this method, most of which have been very carefully traced, there has not been a single relapse.

The final results of the present series of cases as far as traced, are as follows: Well over ten years, 5; well from five to ten years, 17; well from two to five years, 35; well from one to two years, 12; or 57 well upwards of two years; 69 upwards of one year.

As regards the ages of the cases operated upon, my statistics show the following: Under five years, 3; five to ten, 15; ten to twenty, 19; twenty to thirty, 32; thirty to forty, 29; forty to fifty, 11; fifty to sixty, 5; seventy years of age, 1.

These cases have in no way been selected and the method has been employed in the largest hernias with equally good results. There have been no complications, with the exception of a slight phlebitis in one case, which soon disappeared.

Mortality.—In the non-strangulated cases, there has been no mortality, and only one case of suppuration. In the strangulated cases, four in number, there was one death, in a woman, 55 years of age, in whom strangulation had existed for three days and the patient was in a desperate condition, necessitating resection of a large portion of the intestine. In another case, of strangulation, a man 70 years of age, operation was performed in a tenement house in a small town. The patient apparently made a good recovery, but died two to

three weeks later of some unknown cause. The physician in charge did not believe that death was in any way connected with the operation, although I do not think it fair to exclude the operation as a possible cause.

In the most recent edition of von Bergmann's Surgery it is stated that "simply closing the external femoral ring would accomplish little more than closing the external inguinal ring. Modern methods attempt to close the entire canal, including the internal ring."

Bacon of New Haven attempts to apply the same line of reasoning to the femoral as to the inguinal canal. He argues that the lesson taught by Bassini in inguinal hernia, that the proper place to start the obliteration of the canal is the internal ring, should apply with the same force to the femoral canal. He states that "the plans for the closure of the femoral canal have, until most recently, been subject to the same insidious defect which invalidated, more or less completely, the older of the so-called modern operations for hernia of the inguinal form, in that however firmly the crural end of the femoral canal has been closed, its abdominal end has not been satisfactorily obliterated, and thus the opportunity has remained for a knuckle of gut or a bit of omentum to insinuate itself along the tract of the old hernia, and so, in a certain proportion of cases, provoke its recurrence."

The earlier purse-string methods for closing the femoral canal, first brought out by Cushing and Marcy, 1888–89, while admitting that they are a distinct advance over the previous operations of plugging or invaginating tissues into the femoral opening, Bacon considers inferior to the method of Bassini. However, in the latter, he says, there are two weak points:

1. That the abdominal orifice of the femoral canal is not closed;

2. That "the breach in the belly wall is attacked at the wrong end of the femoral canal; furthermore, that the crural arch itself is closed at a mechanical disadvantage."

Kammerer,[6] in a more recent article on Femoral Hernia,

FIG. 2.

gives expression to a similar criticism, and states that Bassini's method practically only closes the external femoral ring. He further adds: "The same, I think, can be said of the various forms of the purse-string suture which, if anything, only creates greater tension." Kammerer believes that the method of Fabricius, in which an attempt is made to obliterate the opening at the internal ring by dividing the superior cornu and some of the fibres of Poupart's ligament sufficiently to relieve all tension and permit the parts to be sutured to Cooper's ligament, is a distinct improvement over Bassini's operation or the purse-string suture and the Lotheissen and Gordon methods he regards as still better.

The point I would make in discussing these various criticisms of the Bassini and purse-string methods, is that the value of an operation in surgery cannot be settled thus easily, and least of all can it be estimated according to the degree to which it fulfills certain theoretical geometrical or mechanical conditions. There are a great many other factors that enter into the question. Let us take, for example, the McBurney operation for inguinal hernia. Theoretically, it seemed an ideal operation. Yet experience proved it to be of little value, because it failed to take into consideration the fact that scar tissue subjected to pressure or tension has the power of stretching or yielding indefinitely. Many of the more complicated methods for femoral hernia, while they may be theoretically and mechanically correct in principle, depend for their success upon some seemingly minor factor which is given too little consideration, yet which may completely annul their supposed superiority. This is well illustrated by those methods in which the canal is perfectly closed and obliterated by means of metal nails or silver-wire sutures; yet, the very presence of these foreign bodies often brings about secondary sinuses with suppuration, which, in turn, may be the chief cause in producing a relapse.

As to the Gordon method, so strongly advocated by Bacon and Kammerer as well as the other methods of closing the

femoral ring from the inner side, necessitating opening the inguinal canal, the possibility of an inguinal hernia resulting from an attempt to cure the femoral, should not be lost sight of. Not a single surgeon has reported more than an insignificant number of cases operated upon by any of these methods and in none of the reports were the cases traced for any length of time.

While we may be willing to grant the truth of the statement of Bacon that "it is far better to follow a mechanically correct paradigm than to practice an operation whose mechanical deficiencies must be supplemented by peculiar skill or extraordinary experience on the part of the operator," yet, it must be conceded that, if the success of the simpler operation of Bassini and the purse-string methods depended upon peculiar skill or extraordinary experience on the part of the operators, how much greater skill and experience would be required to successfully perform an operation like the Gordon method, for the understanding of which Bacon himself has thought it necessary to devote seven pages of description?

The value of an operation for femoral hernia, as the value of all operations in surgery, should, I believe, be estimated not by trying to ascertain how nearly it fulfills certain theoretical considerations, however important they may appear to the individual surgeon, but by finding out to what extent they meet two very practical tests: 1. Simplicity, including safety; 2. Efficiency; that is, permanence of cure.

Of two methods of operation giving equally good results, that method which is the simpler, and more easily performed, should have the preference.

The purse-string method that I have described, I have used in 100 operations without a single relapse. These operations, extending over a period of fifteen years, and including all varieties of femoral hernia, without distinction as to size of the hernia or age of the patient, would seem to show that the method had satisfactorily stood the practical tests that I have laid down. Moreover, it is the simplest in technique and

most easily learned of all the various methods with which I am familiar.

In discussing my earlier results, Kammerer[7] states that he does not believe sufficient time had elapsed to warrant definite conclusions as to ultimate results, and quotes the statistics of Heidenthaler to show that the femoral hernia in which the external femoral opening has been sutured, recur very late, on an average after two years.

Heidenthaler's article was published in 1890, and Kammerer himself states that Bassini's article, published in 1894, represents the first systematic attempt to close the femoral canal in addition to ligating the sac. It is true that there were a few earlier cases reported by Marcy, Bull and Cushing, in 1889–90, but these cases were manifestly too few and widely scattered, as well as imperfectly traced, to enable Heidenthaler as early as 1890 to draw any conclusions as to the interval of time between operation and relapse in cases operated upon with closure of the external ring.

At the Hospital for Ruptured and Crippled we have kept very careful records of all cases of relapsed hernia operated upon by various methods and in various clinics during the past sixteen years. An analysis of these cases, already published in previous papers, shows that in 504 relapsed cases, including all varieties of hernia, the relapse occurred during the first six months after operation in 83 per cent. and during the first year in 90 per cent. of the cases.

This experience is confirmed by the findings of Pott, who in a series of 145 collected cases found that recurrence took place within the first six months, in 71.66 per cent., and during the first year in 91 per cent.

In these statistics no attempt was made to separate the femoral from the inguinal relapses, but in view of the point raised by Dr. Kammerer, I have recently made a study of the entire list of femoral cases, with the following result:

Within the past sixteen years, twenty-eight cases of relapse following operation for femoral hernia have been observed at

the Hospital for Ruptured and Crippled. Of this number the time of relapse is not definitely stated in three; in eleven it took place within the first six months after operation, in six, between six months and a year; or seventeen relapsed within the first year, being equal to sixty-eight per cent. Five cases (twenty per cent.) relapsed after one year and only three (or twelve per cent.) later than two years after operation.

The method of operation in these cases was not in all instances definitely stated, but in the majority some attempt was made to close the external ring.

These results fail to confirm the opinion expressed by Heidenthaler, that most of the relapses of femoral hernia occur after two years, but show that—as in inguinal hernia—the great majority of relapses are observed within the first year after operation, and only twelve per cent. after two years.

[1] Deutsche Zeitschr. f. Chir., 1903.

[2] Loc. cit.

[3] Med. Rec., vol. 57.

[4] Arch. f. Klin. Chir., 1894, vol. 47.

[5] In my earlier cases I used a special needle, somewhat resembling an aneurism needle, for the introduction of the purse-string suture, but soon gave it up for the Hagedorn needle which, with a little care, may be used with perfect safety and much greater facility. I now use a needle holder.

[6] ANNALS OF SURGERY, 1904, vol. 39.

[7] Loc. cit.

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CYSTS OF THE URACHUS.

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THE literature on the subject of cysts of the urachus is not voluminous and is much scattered. Statistical papers are very rare. Wutz,[1] writing in 1883, denies that any large, clinically-important cyst of the urachus had been reported up to that time. He analyzes all the alleged cases, whether found at autopsy or seen clinically, and rejects them all; because they represent either notable diagnostic errors or data too scanty to justify a diagnosis. He gives no formal conclusions, but simply analyzes each reported case. He evidently expects that a typical case should show in its cyst-wall the presence of each anatomical layer of the urachus from which the cyst is believed to form by partial dilatation. Thus, in an ideal case we should find, first, stratified epithelium, and second, smooth muscle fibres, as well as the non-dilated portion of the urachus. The cyst should also lie outside and in front of the peritoneal cavity.

The minute cysts claimed in his day as urachal are summed up as follows:

1. All have their seat in the lower fourth or third of the distance or space between the navel and vertex of the bladder, and proceed from the normal, persistent portion of the urachal canal.

2. The majority have stratified pavement epithelium; a few, only a single layer.

3. All cases have a more or less pronounced envelope of smooth muscle fibres.

4. Size from microscopic to bean.

The essentials are not demonstrable in the alleged large cysts of the urachus reported at autopsy or clinically.

Small cysts, microscopic to bean size, he claimed were relatively frequent, as he had seen seventy-four cases; but as these are of no clinical importance I shall not consider them in my statistics.

Doran,[2] like Wutz, whose critical acumen he praises, does not indulge in any concluding generalizations, but, using Wutz as a guide, is content to show that all reported cases of urachal cysts of large size are more or less defective.

His own case is apparently well documented, and he seeks to show that it could not have been any other pathological condition, such as might form in that locality (organized peritoneal effusion, encysted dropsy, abscess cavity, etc.). Yet despite positive evidence and results of exclusion, he does not seem to commit himself to an absolute diagnosis. He is evidently deterred by the fact that Wutz, with much better opportunities for exact work, was led to a non-committal point of view.

Cases other than his own are discussed pro and con with the outcome that they are not beyond criticism, although in many cases satisfactory for ordinary requirements.

Thus, the conclusions reached by both Wutz and Doran are seen to be destructive rather than constructive to the statistical side of my subject.

The reports by Hoffman[3] in 1870, Wolff[4] in 1873, and Atlee,[5] 1873, furnished about the only information upon the subject until Tait's[6] article appeared in 1883, followed in 1886 by his report of twelve cases as reported to the British Gynæcological Association.[7]

To Mr. Tait belongs the credit of being the first to make a diagnosis in these cases prior to operation. His teachings were of great value in explaining this bewildering pathological condition to the abdominal surgeon of twenty years ago.

Since that period a few writers have studied and reported upon the subject.

Dr. F. Byron Robinson[8] has reported four additional cases operated upon by Tait and two personal cases seen elsewhere. He reports his observations in studying the urachus of the fœtal calf, fœtal pig, cow, dog, sow and sheep. The bulk of the paper is made up of his observations while with Mr. Tait, followed by his conclusions. The paper is of much value to the student of this pathological phenomenon.

Freer[9] and Douglas[10] also furnish comprehensive articles upon the subject, with report of cases.

My own cases, three in number, are rather typical of the more serious type of these cases by reason of their considerable size and their dipping down into, and being adherent to, the pelvic viscera; and their being in each case extra-peritoneal, with bladder attachment, makes the diagnosis conclusive.

Case I.—Female, age 75. Family history negative. Patient had, aside from diseases of childhood, always enjoyed perfect health. Had three children, with normal pregnancies and labors. For fifteen years had suffered the inconvenience of a discharge of pus from the umbilicus. The discharge was constant, and at times, following an enlargement of the abdomen and pain, it became profuse, relieving the pain and causing the swelling to diminish to such an extent that care was required in its detection.

At various times she had consulted physicians in reference to the condition, but aside from prescribing various washes and ointments, no treatment or diagnosis was offered.

She was finally referred to me, and an examination revealed the following conditions: Patient well preserved and active for her age. The abdomen was very fat, and a tumor, cocoanut size, presented in the median line between the umbilicus and symphysis pubis. The mass could be raised with the abdominal wall, and was apparently attached thereto.

There was a copious discharge of foul-smelling pus from the umbilicus, and an eight-inch probe passed into the sinus failed to reach the lower wall of the sack. The temperature

was 101°; pulse 100. She volunteered the information that it was no worse than usual, but she was not feeling so well generally, and there had been, during the past month, very frequent micturition.

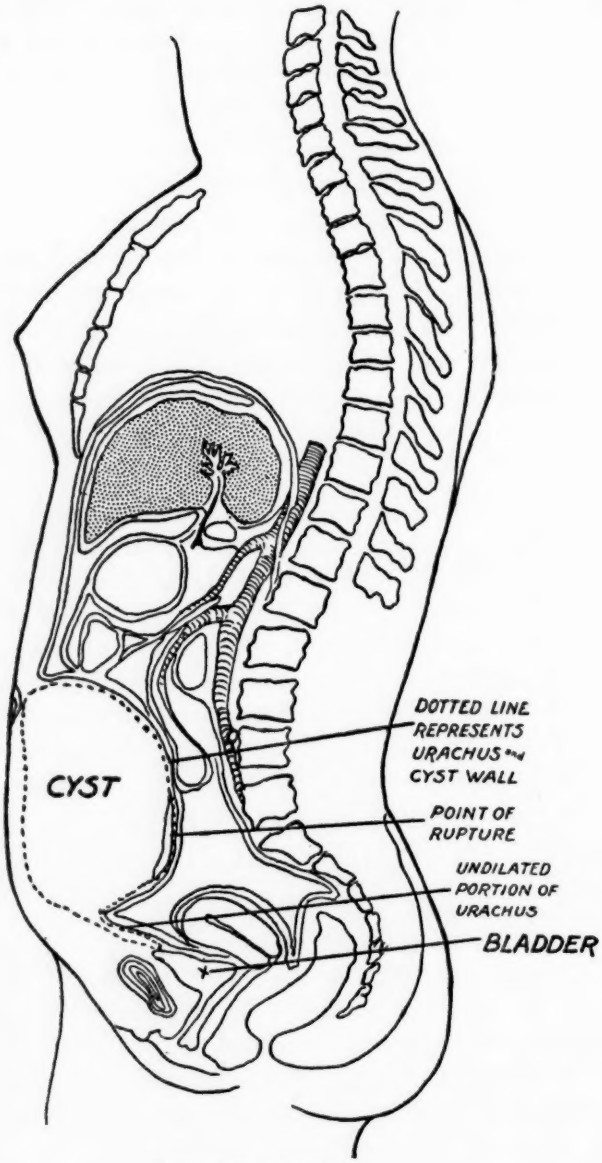

FIG. 1.—Cyst of Urachus.

Under ether anæsthesia I excised the umbilicus and unhealthy skin surrounding it, and, incising down through two inches of fat, came upon a bulging mass extending from the umbilicus as far down as I could feel toward the symphysis pubis. (Fig. I.) This I tapped, and evacuated about five ounces of horribly fetid pus, followed by a calculus weighing 70 grains. Exploration with the finger demonstrated the fact that the cyst had a thick and indurated wall and dipped well down to the pelvis.

Up to this point in the operation I had not opened the peritoneal cavity. I now washed out the sac and packed it with gauze and entered the peritoneal cavity above the location of the tumor. To my surprise I found the mass densely adherent to the intestines posteriorly, and, passing my hand down into the pelvis on the outside of the cyst, discovered it to be closely associated with the bladder. I now concluded that I was dealing with a urachal cyst, and as the posterior wall was almost entirely made up of intestines, I concluded to cut away such portion of the sac as seemed safe. I left the posterior wall intact, as well as that portion which dipped down into the pelvis. The wound was closed so far as I had peritoneum and the balance walled off with a coffer-dam drain of iodoform gauze. Her recovery was uneventful, but required three months to close the sinus.

Case II.—Female, aged 11. Was admitted to the Mercy Hospital April 11, 1905, with the following history furnished by Dr. M. W. Pearson, who referred the case.

The child had complained for some days of headache and vomiting, gradually developing slight tenderness and some pain in the abdomen, but not severe at any time. There was at first no localized tenderness and very little distention. One week prior to admission a general flatness was noted, with fluctuation. The abdomen became more and more distended.

On admission her temperature was 101.2°, pulse 172, respiration 30. The child was pale and emaciated, with a dry tongue and anxious expression. She complained bitterly of abdominal pain, and the entire abdomen was tender, but especially so about the umbilicus. The abdomen was greatly distended and board-like. Flatness extended from the umbilicus to symphysis pubis and from a point two inches to the right of the median line, almost completely into the loin on the left side. Entirely

surrounding but especially above the umbilicus was a zone of redness one and three-eighths inches in diameter, which represented an area through which the abscess was ulcerating toward the surface. A positive diagnosis was not made prior to operation, but tubercular peritonitis and suppurative urachal cyst were both considered.

Under ether anæsthesia the abdomen was opened in the median line between the umbilicus and symphysis. Absence of the peritoneum made a diagnosis quickly possible and a peculiar state of affairs presented. The abdominal cavity was divided into two compartments by the sac wall, which displaced the intestines almost entirely to the right side of the cavity and walled them off. Almost the entire left side below the umbilicus was filled with the cyst, which had ruptured, as shown by Diagram No. 2. Except at the point of rupture the cyst contents were entirely extra-peritoneal, although occupying so large a part of the abdominal cavity. Several pints of free pus was confined to the left side and was not in contact with the intestines.

The position occupied by the mass is fairly well shown in diagram, Fig. II. The urachus was patulous down to within three-eighths of an inch of the bladder and was ligated at that point; so much of the sac as could be dissected out without tearing up the limiting wall was taken away, and the abscess cavity washed out and drained with a coffer-dam drain of iodoform gauze.

An area two by four and one-half inches was bare of peritoneum at the site of wound, but there has been no trouble from this source.

Case III.—Male, aged 73. Referred by Dr. Stowell. Family history negative. Had always been well, except an attack of orchitis four months previous. For six months he suffered with pain and soreness in the abdomen, but noticed no tumor. Two weeks before my visit the abdominal wall opened spontaneously two inches below the umbilicus and discharged urine. There had never been any pus. If lying down quietly the urine did not escape, but so soon as he assumed an upright position there was a constant discharge.

The old gentleman appeared perfectly well aside from this urinary sinus, which was about the circumference of a pencil

and entered immediately into a large sac, the lower limit of which I could not reach with an eight-inch probe.

Under ether anæsthesia I entered the peritoneal cavity

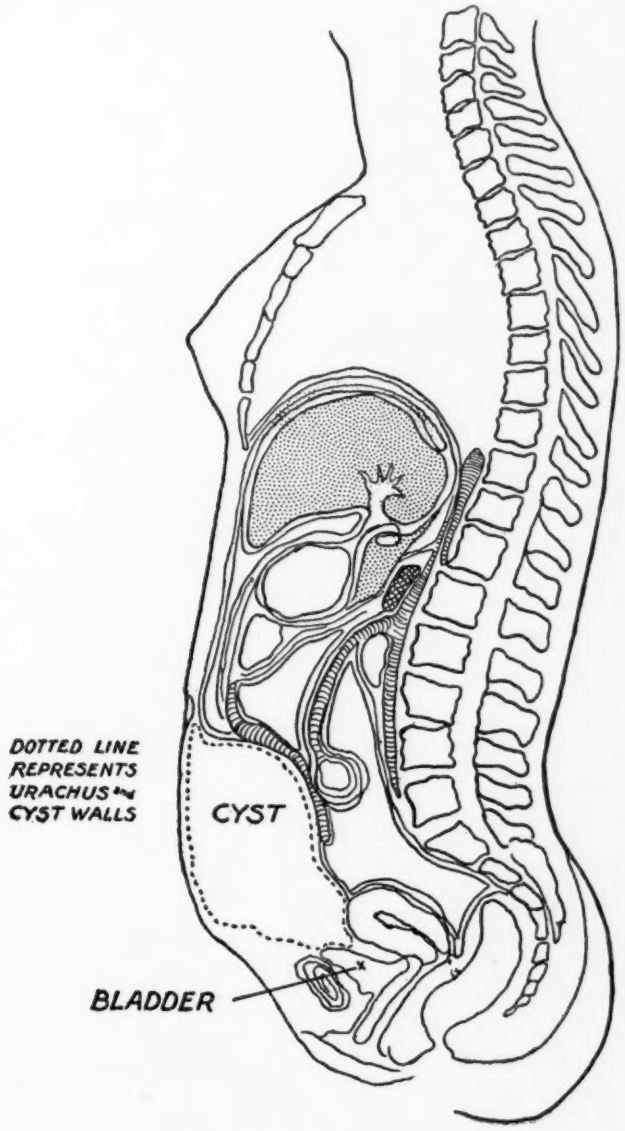

FIG. 2.—Cyst of Urachus.

above the sinus and found the sac anterior to the parietal peritoneum. The sac extended to within one inch of the umbilicus, above which the urachus was not patulous (Fig. III.), and down-

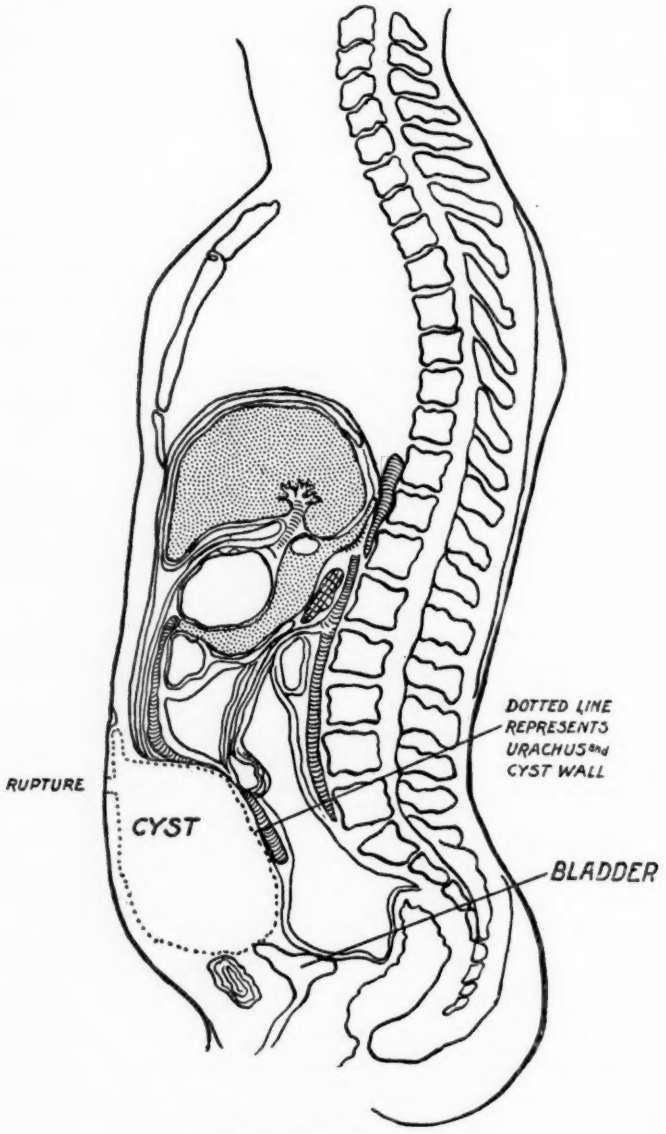

FIG. 3.—Cyst of Urachus.

ward into the pelvis. It was intimately connected with the bladder at the point of urachal contact and was densely adherent to the posterior bladder-wall, as well as to the intestines, the greater part of the posterior sac-wall being made up of abdominal viscera. After freeing the anterior wall of the cyst sufficiently, I made a plastic closure of the original point of rupture through the abdominal wall. A catheter was passed into the bladder through the urethra and allowed to remain for several days. The abdominal wound was closed without drainage. Patient made an uninterrupted recovery and was about the house on the fourteenth day.

Two months later I was told by Dr. Stowell that the abdominal wall had given way again a trifle lower down toward the symphysis, and urine is again discharging through a small sinus. I have advised its closure, but shall not attempt anything more radical than plastic closure, not entering the peritoneal cavity, since I think total extirpation impossible.

Since writing the above, I am informed by Dr. Stowell that the opening has closed spontaneously, and urine is voided entirely through the urethra.

TABLE OF CASES OF CYST OF THE URACHUS REPORTED IN MEDICAL LITERATURE.

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
1	Wolf, Inaug. Dessertation Marburg, 1873.	31	F.	Two years before had noted small tumor in left lower abdominal region. Fever present. Was in fourth month of pregnancy. Next few days rapid increase in size.	Incision and evacuation of fluid. Mass extirpated.	Five litres yellowish serous fluid.	Not stated.	
2	"	2½	M.	Moisture about navel from time of birth. Blood and pus discharged from time to time but never urine. Small aperture in lower part of ring. Upon pressure serum escapes. A sound introduced reveals a canal running in a downward direction along linea alba.	Opening dilated by a laminaria tent whereupon a teaspoonful of yellowish-green pus escaped.	Teaspoonful of yellowish-green pus.	Discharged without cure.	
3	Atlee, Ovarian tumors, 1873, p. 50.	18	F.	When about to remove an ovarian tumor, the incision in linea alba, between umbilicus and pubis, opened a small cyst from which an ounce of yellowish fluid escaped. He finished the ovarian operation and closed the wound. Six days later dressings began to be saturated with a thin fluid which was devoid of smell. Urine passed normally. Nevertheless the oozing fluid was later found to be the same as that escaping by the urethra.	Patient ordered to void urine frequently whereupon the escape of fluid from the wound ceased and the wound closed completely.	Yellowish thin fluid devoid of smell.	Cured.	
4	Scholz-Bericht I. K. K. allgemein. Krankenhauses, Wien, 1877.	16	F.	Vesical tenesmus, tumor and tenderness in abdominal region. Belly prominent, ovoid, largest just below navel, where a hard fluctuating mass was present. Navel gradually became thin and opened, an albuminous-like fluid oozing forth.	Opening dilated and fluid evacuated. No further operation.	300 C. C. colorless transparent fluid. Tenacious. Eventually much thick yellow pus.	Healed in two months.	No diagnosis.
5	Roser, Arch. f. klin. Chirurgie, 1876, XX. p. 472.		F.	Three months pregnant when acute abdominal swelling appeared. Tapped and pregnancy went to term with normal delivery. Four years later, pregnant again. Fluid reappeared, patient aborted. Temporary communication between cystic mass and bladder.	First tapped and wash-basin full of fluid removed. Second operation, laparotomy, incision of cyst and evacuation of three litres of foul ammoniacal purulent, fluid. After a long period during which catheter was passed every two hours, it healed.	Foul purulent ammoniacal fluid.	Cured.	

9	Hoffmann, Arch. f. Heilkunde XI, p. 373.	28	M.	Thick abdomen even in youth. Increased in size at 24, with dyspnœa, fluctuation to right side, for which he was tapped. Patient well for two years when he again became worse.	Tapped and two years later a second tapping.	Reddish-yellow thin fluid. Seventy-five litres at second tapping.	Death.	After death fifty litres residual fluid in sac. Diagnosis at autopsy.
7	"	28	M.	One year before had fluctuation beneath costal arch to left. Pains in right lower abdominal cavity for ten years.	Tapped twice.	Six litres greenish-yellow clear and albuminous fluid. Second tapping 103 litres bloody fluid becoming purulent and urinous.	Death.	Diagnosis at autopsy.
8	McLean, Md. Record, Feb. 8th, 1879.	24	F.	In 1867 pains and bloating in abdomen with indications of growth in left iliac fossa. In 1876 the mass attained large dimensions. Abdomen uniformly enlarged.	Laparotomy after tapping abdomen. At lower angle of incision a cyst of the abdominal wall was wounded, two drachms of pale fluid escaping. Large mass was ovarian tumor, multilocular. This was removed and pedicle ligated. Bladder had been wounded and was repaired.	Pale fluid.	Death, 30 hrs. after operation.	Autopsy showed bladder to be intact and densely adherent to abdominal wall.
9	Heinecke, Billroth, and Pithas, Allgem. und Speciale Chirurgie, 1879, III, 2, 2, p. 64.	33	F.	Primipara. Two years before, abdominal distention noted. Most marked below navel. Dull to percussion on left side as far back as lumbar region. Puncture with evacuation of albuminous fluid and numerous squamous epithelial cells in fatty degeneration.	Laparotomy, cyst exposed by the incision. This was incised and emptied and an attempt made to dissect it out. After much trouble the anterior wall was detached from the abdominal parieties and an attempt made to roll the mass out but this was impossible as intestines seemed to be part of the posterior wall.	Albuminous fluid and squamous epithelia in fatty degeneration.	Death "soon after."	At autopsy the author seemed to think his diagnosis of urachal cyst wrong and that the real condition was encapsulated peritoneal exudate.
10	Helmuth, Contributions to Gynecological Surgery, p. 16.	54	F.	Multipara. When 14 years old a mass the size of an apple formed at the navel and burst with projectile escape of water. After menapause at 44, the abdomen became enlarged and tender.	Tapping and then laparotomy. A peculiar mass exposed which was adherent to abdominal wall. Incised with escape of fluid. This cyst was pushed aside and a large ovarian cyst extirpated. The smaller cyst communicated with the bladder. Its walls were repaired in a suprapubic lithotomy.	Quart of dark viscid fluid.	Death from peritonitis on fifth day.	No autopsy.
11	Helmuth Case reported by Freer, ANNALS OF SURGERY, 1886, V, p. 110.	2 or 3 mos.	M.	Said to pass urine through the navel. A hollow growth one and one-half inches long at navel communicating with a pervious urachus. Discharge continuous.	Operation of ligation proposed but refused.	Urine.		

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
12	Freer, ANNALS OF SURGERY, V, 1887, p. 107.	Middle aged	F.	Inability to urinate at will, by reason of cyst of urachus which filled up to extent of several litres. By compressing the cyst, she could empty the bladder in part only. She became pregnant and it was necessary to tap her. After gestation, she did well for four years, when she again became pregnant. She was tapped again and aborted. The communication between cyst and bladder closed spontaneously and patient had no further annoyance.	Tapped twice.		Recovery.	
13	Freer, ANNALS OF SURGERY, V, p. 112.	10	M.	Urine contained blood and pus and treated successfully, but shortly afterward urine began to escape from navel. Just before this happened a growth which had appeared at the navel ruptured.	Fistula dilated with a laminaria tent and fistula closed by cauterization and use of subcutaneous ligatures. Ten days later re-opened, suppurated and was again closed. Plastic operation for umbilicus followed by peritonitis.		Death.	Autopsy old peritonitis. Trabecular bladder which also contained a septum between uretral openings. Cystic cavity communicated with bladder and contained two openings, marking site of ruptures which had caused peritonitis.
14	Freer, ANNALS OF SURGERY, V, p. 110.	40	F.	Purulent discharge. Sound introduced at navel, located a cavity three inches broad at widest diameter. Several ounces of pus could be squeezed out. Communication between cyst and bladder.	Cyst treated anticeptically and healed without operation. Patient stated that this had been done several times before.	Pus.	Cured.	
15	Freer, ANNALS OF SURGERY, V, p. 111.	26	M.	Had a large abdomen since infancy. Marked increase in size recently. Fluctuation, in and around umbilicus. Dyspnœa increasing necessitated tapping. Remained in good health for two years when abdomen re-filled and patient became cachectic. Second tapping brought away six litres bloody fluid. In next nine months three more tappings, 18¾, 17 and 6 litres respectively.	Repeated tappings.	Considerable reddish-yellow fluid at first tapping.	Death.	Autopsy. Patient weighed 192 lbs. but cyst contained 50 litres of fluid equal to 100 lbs. weight. Cyst did not communicate with bladder. A smaller cyst lay between it and the bladder

91	Bramann, Arch. f. klin. Chirurgie, 1887, XXXVI, p. 1004.	36	F.	Eighteen years before, an abdominal tumor had appeared, with high fever, pain, vomiting, etc. Attending physician found tumor size of fist in umbilical region, a little to the right of and above the navel. This persisted with fluctuation in size, and a tendency to approach the symphysis. Two years later rupture at navel and escape of foul pus. Fistula persisted until present consultation. Oval tumor exactly in median line reaching from navel to symphysis and five c.m. wide. Urine had always been voided normally.	Laparotomy. Incision to fistula with escape of pus. Extraction of four concretions size of pigeon's egg. Fistulous tract curetted and cavity of cyst tamponed and afterward drained with tube.	Foul pus.	Recovery after three months.	Concretions appeared to be gall stones. Author unable to account for their presence.
17	Flemming, Trans. Glasgow Pathol. and Clinical Society, 1888, III, p. 99.		M.	Admitted to hospital for swelling inguinal region, which appeared after he had jumped from a cart. Thought he had sustained a rupture and put on a truss. No improvement. Swelling persisted and grew larger. Large fluctuating mass above Pouparts ligament on right side. Crural ring intact. Yellow fluid aspirated by needle. Later nine ounces dull yellow fluid removed by trocar and iodine injected. Fluid behaved like hydrocele fluid. Said to contain spermatozoa, also cholesterin.	Laparotomy. Cyst incised, scraped and drained.	Yellow fluid.	Recovery.	
18	Teichelmann and Tait, Lancet, 1888, II, p. 675.	28	F.	Fever and vomiting were followed by appearance of hard painful tumor between umbilicus and pubes somewhat to the left side. No mention of suppuration at any time or of a diagnosis before operation. Cyst a large one dipping into pelvic cavity attached by short pedicle to abdominal wall.	Laparotomy. Enucleation. Cavity drained and margins stitched to abdominal wall. Peritoneal cavity was separately drained.		Recovery in three weeks complete.	
19	Schullenbach, Inaug. Dissertation, 1888.	66	M.	Fistula at umbilicus which discharged a turbid fluid constantly. Urine could be withdrawn through fistula by catheter.	Laparotomy. Incision of cysts with escape of a litre of pus and urine. Cyst extirpated.	Pus and urine.	Recovery.	

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
20	Lawson Tait, British Gynecological Journal, 1886-7, II, p. 328.	56	F.	Abdominal pain and tenderness, vomiting, swelling of abdomen. These increased for four months when tapped for a supposed ascites. Ten pints of fluid drawn off. Not ascites but cystic. Diagnosis of parovarian cyst. Fluid re-collected at once.	Laparotomy. Cyst incised. Thirty pints evacuated. Much fibrin present. Cyst now extirpated. Uniform attachment to parietal wall in front and peritoneum behind. Cyst removed bodily. Inner aspect of broken-down epithelium infiltrated with pus. Muscular coat beneath epithelium.		Death in three days.	
21	"	39	F.	Great pelvic pain and abdominal swelling. Hard mass to be felt on left side, which in two months had become central. Amenorrhœa purulent urine. Supposition of ovarian cyst.	Laparotomy. Cyst tapped and seven pints putrid urine drawn off. Cyst everywhere adherent. Separated as far as possible behind. Wound closed and drained with tube. Urinary fistula remained about a month after operation. Patient aborted, dying suddenly.	Putrid urine.	Death in one month.	No autopsy.
22	"	39	F.	Condition dated back three years and when seen by Tait appeared too far gone for intervention.	Laparotomy. Cyst gangrenous and full of pus. Peritoneal cavity not opened. When stitches were removed the wound re-opened and discharged dark unhealthy pus.	Pus.	Death in seventeen days.	No autopsy.
23	"	21	F.	Symptoms of parovarian cyst.	Laparotomy. Cyst found to be extra peritoneal. Contents clear. Cyst emptied, sponged out, and drainage tube inserted. Suppuration began immediately and continued profusely until patient died of exhaustion.	Clear fluid.	Death in six weeks.	No autopsy.
24	"	33	F.	Profuse menstruation for which she was curetted with benefit. Shortly afterward had chills followed by evidence of peritoneal effusion. Physical signs of encysted fluid, evidently purulent.	Laparotomy. Condition found exactly like that in last case save that contents of cyst were purulent. Drainage as above.	Pus.	Death.	No autopsy.
25	"	37	F.	Symptoms of pelvic tumor. From its relations expected a condition like all the preceding, *i.e.*, an extrapreitoneal cyst.	Laparotomy. Cyst emptied and drained. Case did well for twelve days when all the urine began to appear through the tube. Sinus finally closed without operation.		Cured.	

26	Lawson Tait, British Gynecological Journal, 1886-7, II, p. 328.	17	F.	Large tumor of abdomen and pelvis.	Laparotomy. Cyst evacuated by incision, six quarts clear fluid coming away. Drainage tube inserted.	Clear fluid.	Cured.	
27	"	17	F.	Two months before consultation abdomen began to enlarge. Hectic appearance indicated suppuration. Diagnosis of purulent peritonitis.	Laparotomy. Condition found exactly like the preceding case. Circular drainage.	Clear fluid.	Cured.	
28	"	29	F.	Confined three weeks before. Began to increase in size enormously, immediately after.	Laparotomy. An intraperitoneal cyst found containing nine pints of fluid. Peritoneum not opened. Circular drainage, a tube being passed through the retrouterine cul-de-sac into the vagina.		Cured.	
29	"	41	F.	History of ovarian tumor which had been tapped and operated. Thought to have been a sarcoma with subsequent infection of peritoneum (Thornton).	Laparotomy by Tait. Old scar found in cyst wall. Case inoperable but not sarcomatous. No solid portion found. Drained.		Cured.	
30	"	17	F.	Referred to Tait as acute inflammatory disease of abdomen. Exact diagnosis impossible. Pulse and temperature high and much free fluid in abdomen.	Laparotomy. Piece of cyst excised for diagnosis. Circular drainage.		Cured.	Microscopical diagnosis Allantoic cyst.
31	"	23	F.	Ailing for nine months and in bed two weeks. Hectic and emaciated.	Cyst tapped and six pints of purulent serum evacuated. Incision extended and diagnosis then made of allantoic cyst.	Purulent serum.	Cured.	
32	Bantock.	30	F.	Abdominal tumor. No history.	Laparotomy. Incision of cyst and evacuation of twenty-five pints of thick grumous fluid. Attempted extirpation but had to be abandoned. Cyst washed out with iodine and wound closed with drainage tube. Peritoneal cavity not opened. For many weeks a thick mustard-colored discharge.	Thick grumous fluid.	Recovery.	
33	Bantock.	37	F.	Taken violently ill with pain in stomach, fever, swelling of abdomen. Seven weeks later tapping necessitated. Over a gallon thick yellow fluid evacuated. Second tapping necessary.	After two tappings a laparotomy was done. Attempt to cut out a fistulous tract in site of trocar opening led to accidental opening of cyst containing several pints of purulent fluid. Cyst washed out and treated exactly as in previous case.	Thick yellow fluid.	Recovery.	

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
34	Tait. Reported by Byron Robinson, ANNALS OF SURGERY, 1891, XIV, p. 350.	17	F.	Fluctuating mass in lower abdomen and pelvis. Showed peculiar difference from ovarian and parovarian cyst. Only history given was that of irregular menstruation for eighteen months with poor health.	Laparotomy. Cyst wall which was very thick and brittle, incised. Could not be separated from its bed. Contents thick and pultaceous. Walls could not be collapsed. Cavity irrigated with iodine water, wound closed at first without drainage, but five days later suppuration began and circular drainage was then instituted.	Thick and pultaceous.	Recovery in six weeks.	
35	"	9	F.	History so much like preceding that description is omitted by author. History of supposed gastritis four weeks before, when swelling was first noticed. Then became very anæmic.	Laparotomy as last resort. (No mention of diagnosis at time.) Condition recognized during operation as cyst of urachus. Incision and evacuation of thick pus, irrigation, abdomen closed with drainage.	Pus.	Recovery.	
36	"	40	F.	Had been ill some time. Hard mass in abdomen.	Laparotomy. As usual no peritoneum found. Diagnosis of cyst of urachus. Wall cheesy and friable as were also contents. To the naked eye, condition was tuberculosis. Cavity irrigated with iodine, wound closed with a single glass drainage tube. First postoperative week was febrile.	Semi-solid and cheesy.	Recovery to surprise of Tait.	
37	"	17	F.	Never menstruated. Was thin and anæmic. For past six months ill and for most part of that period in bed. As is so often the case her general condition suggested tuberculosis. Diagnosis of urachal cyst made before operation and confirmed.	Laparotomy. Cyst filled with cheesy matter. Tait pronounced this case hopeless as he did the preceding one. As before he closed the wound, after irrigation, with a single drainage tube.	Cheesy.	Recovery from operation but when seen afterward was evidently succumbing to tuberculosis.	
38	Not one of Tait's but occurred in practice of a colleague of Dr. Robinson.	12	M.	Abdomen enlarged for months with diagnosis of peritonitis. Later evidences of a pelvic cyst, but no further diagnosis.	Laparotomy. Surgeon puzzled to find no peritoneum. Cyst incised with escape of pus and cheesy matter. Abdomen closed with silk and a glass drain left in.	Pus and cheesy matter.	Recovery.	

39	Robinson, as above.	10	M.	It is only stated that this case was a post-mortem specimen. No clinical particulars, nor is it stated whether the cyst or an operation for it had anything to do with the patient's death.			Death.
40	Dossekker Bruno Beiträge zur Klin Chirurgie 1893, X, p. 102.	43	F.	Four years before, after severe puerperium became run down, with lancinating pains in right lower abdomen. Some months afterward, tumor palpable through vagina, to right of uterus regarded as ovarian cyst. Improved under vaginal douches, mud baths, etc., but in course of a year became worse. Tumor grew larger and attacks of pain occurred. Afterward, fever, vomiting, etc.	Laparotomy. Cyst accidentally opened as it adhered to parietes; exit of three or four litres of bloody fluid. Laborious attempts to dissect out cyst with rupture of wall in places. No pedicle. Cyst did not enter pelvis. Peritoneum not open. Silk sutures, drainage at lower angle. Healing by first intention.	Bloody fluid.	Recovery.
41	Vanderveer, Medical and Surgical Reporter, 1889, LXI, p. 661.	20	F.	Umbilical fistula from birth. Irregular discharge, profuse at times. Getting worse for past two years. Discharge very offensive.	Incision of fistulous tract. Considerable sinus exposed. Diseased surfaces curetted and cavity packed.	Pus.	Recovery in two or three months.
42	Vanderveer, Journal of Obstetrics. 1897, XXVI, p. 567.	Young	F.	Cyst not large, evidently fistulous.	Operation. No details.	Offensive discharge.	Cured.
43	"	Young	F.	Cyst not large, evidently fistulous.	Operation. No details.	Offensive discharge.	Recovery.
44	"			High fever and symptoms pointing to abscess.	Cyst completely enucleated.		Cured.
45	Ill. Transactions Am. Association Obstet. and Gynec., 1892, p. 238.		F.	Had noticed swelling of small size for about ten years. During pregnancy, it enlarged rapidly and at end of third month contained five litres of fluid.	Incision and drainage. Miscarriage two weeks later.		Recovery.
46	Ill. American Journal of Obstet., 1897, XXVI, p. 568.		F.	Urine entered cyst but no inflammation ensued.	Laparotomy. Extirpation. Started to ligate urachus at bladder, but changed mind, cut duct off short and applied Lambert suture.	Urine.	
47	C. A. L. Reed, Am. Journal of Obstet., 1897, XXXVI, p. 568.			Scanty notes. Says he has several cases but no allusion to others.	Attempted enucleation which he gave up when he found that peritoneum was being removed. He boldly removed this flap and to secure approximation, separated peritoneum for two inches back of incision.		Recovery.

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
48	Newman, Glasgow Medical Journal, 1896, XLVI, p. 20.	39	M.	Admitted for pain in hypogastric region of four days' duration. Inability to urinate. Blood evacuated with catheter. Abdomen swollen, dull on percussion over hypogastrium. Swelling resembling a distended bladder. Improvement under expectant measures, but tenderness on pressure and fluctuation lead to intervention. Had a swelling in this locality so far back as he could remember.	Laparotomy. Accidental opening of cyst. Gelatinous contents having ammoniacal odor. Wall thin and smooth, extending from bladder to umbilicus. Cyst evacuated, flushed out and drained with tube, urine escaped into dressings through operation wounds, discontinuing after a month when wound closed.	Gelatinous contents of ammoniacal odor urine.	Recovery.	
49	Morgan, Lancet, 1896, II, p. 1154.	5	M.	No data except that it was a case of supposed peritonitis with no characteristic symptoms.	Cyst opened and it together with bladder were washed out. No attempt to dissect out cyst wall. Wound in cyst closed with double row of silk sutures, superficially placed. No mention of suppuration during operation, but abdominal wound discharged pus and urine for several days.		Recovery in one month.	
50	Carroll, Jane W., Buffalo Medical Journal, 1896, XXXV, p. 869.	34	F.	Recurrent bowel attacks for eleven years. Fever, pain, emaciation. Diagnosis of peritonitis made. When first seen had pain and soreness in right iliac region, tumor palpable. Recurring attacks of fever and pain while under observation.	Laparotomy. Cyst of urachus recognized with numerous adhesions. Dissected out and wound closed.		Recovery.	
51	Douglas, Am. Journal of Obstet., 1897, XXXVI, p. 477.	36	F.	18 months ago noticed swelling in lower abdomen, more marked to right, soft and painless. Grew slowly, up to four months ago, then more rapidly. Digestive disturbances, cough and loss of flesh, later vomiting. Urine normal. Examination gave evidence pointing to ovarian cyst.	Laparotomy. Cyst exposed and aspirated. 25 pints clear fluid drawn off. Diagnosis of urachal cyst now made. Cyst very adherent, but author enucleated it without much hemorrhage. Peritoneal cavity not entered but peritoneum detached from abdominal wall for a considerable area. No attempt to suture it, trusting intra-abdominal pressure would fix it in place. Wound closed without drainage.	Clear fluid.	Death in 48 hours.	Gangrene of detached peritoneum and death due to sapræmia, shown at autopsy.

52	Lexer, Archives f. klin. Chirurgie, LVII, p. 81, 1898.	20	M.	18 months before, after troubles of micturition, the urine being very cloudy, felt pain in umbilical region, which was also swollen. Soon after this, pus escaped at the navel and continued to do so at intervals. Bladder trouble became worse progressively. Patient found to have a gonorrhœal cystitis, duration of infection could not be determined.	Cystitis treated first. In washing out bladder pus appeared at the navel. Attempted radical cure of fistula. The urachus dissected out. Shape of bladder abnormal (tubular). Fistulous tissue extirpated, bladder wound closed.	Pus.	Recovery.
53	Rotter, Deutsch Med. Wochenschrift, 1898, Vereinsbeilage, p. 10.	43	M.	About a year ago hemorrhage from bladder which continued to recur. Tumor size of orange felt above symphysis. Trial puncture, evacuation of turbid, yellow thickish fluid. Cystoscopy revealed tumor of the bladder.	Laparotomy. Tumor intimately adherent behind to peritoneum. Lower pole dipped into bladder. Cyst and tumor both extirpated. Healing throughout by first intention. Diagnosis cancer of bladder complicating urachal cyst.	Thick turbid yellow fluid.	Recovery.
54	Doran, Medico-Chirurg. Transactions, 1898, LXXXII, p. 301.	59	F.	A swelling low down in abdomen more to left side than right. Recurrent peritonitis, swelling of considerable size, no inflammation at first. Pain antedated tumor, going back nine months, while tumor was not noticed until seven months later. Diagnosis before operation was circumscribed peritoneal effusion.	Laparotomy. Cyst incised and emptied and washed out. Its wall adherent to intestines and omentum. Second cyst beneath first, not the bladder. Was tapped and then opened. Two cavities made into one, packed and drained. No urine escaped. Not entirely healed for six months.	Inflammatory products.	Recovery.
55	Micheli Bollettino, I. Societa Toscara di Obstetricia e Genecologia, 1903. II. p. 211.			No history. It is only stated that diagnosis was not made before operation.	The cyst was the size of a pigeon's egg or less. Wall mostly thin, transparent, and contained thick yellowish fluid. Was evidently extirpated whole as shown in plate.		
56	"			No history.	Not so large as preceding (small nut). Walls thicker, filled with thick clear liquid. Extirpated as shown in accompanying plate.	Thick clear fluid.	

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
57	Matthais, Beiträge z. klin. Chirurg., 1904, XLII, p. 339.	48	M.	Came to Mikuliczs' clinic in 1901. Six months before tension in lower abdominal region. Urine turbid, tenesmus of bladder. General health suffered for next three months. Patient then improved, but symptoms suddenly returned to vanish again for two months. Returned a second time. Suspicion of cancer of bladder. Sent to Mikuliczs. Superficially placed, firm tumor, not sharply outlined, below navel, slightly more to right of middle line. Adherent to abdominal wall. Diagnosis of persistent urachus. When urine contained abundance of pus, patient felt better. Tumor varied in size.	Laparotomy. Abdominal wall dissected from tumor. Latter adherent to vertex of bladder. Cyst laid open and found to contain old blood clots and pus. Cyst size of a billiard ball. Water injected into bladder did not escape through cyst. Tumor detached with resulting perforation of the bladder. Bladder sutured and external wound closed.	Old blood clots and pus.	Recovery but fistula in abdomen had not closed at time of discharge.	
58	Patel, Revue des mal, de la France, 1904, XXII, p. 77.	3	M.	Fluctuating abdominal subumbilical tumor in middle line adherent to umbilicus. Persistent incontinence of urine, for which advice was sought. No connection established between tumor and bladder. Cyst of urachus thought of, also diverticulum of intestines, former hypothesis favored.	Medium laparotomy. Tumor exposed. Anterior aspect covered by peritoneum, readily separated. Cyst incised. Wall seemed to be mascular. Clear albuminous fluid evacuated. Impossible to extirpate cyst. Wall sutured together as in case of Hydatid cyst of liver. External wound closed. As cavity communicated with bladder, a retention catheter was inserted and left five days.		Recovery.	
59	Joseph Price,	Young	F.	Pain but complicating other abdominal troubles in all but two cases. All were suppurated, four were diagnosed during, and two before, operation.	Excision and closure in four cases, opened and drained two.			
60	"	"	F.					
61	"	"	F.					
62	"	"	F.					
63	"	"	F.					
64	" Pers'l letter.	"	F.					

65	William J. Mayo,		F.	Slowly growing tumor discovered during sections.	Excision.		Cure.	
66	"		F.		"		Death.	
67	" Pers'l letter.		M.		"		Malignant. Recurred and died 11 mos. later.	
68	Nicholas Senn. Pers'l letter.	45	F.	Swelling between umbilicus and pubes. Discovered during sections.	Excision.		Cure.	
69	Edwin Martin.		M.	Fusiform, inflam. tumor. Diagnosed before operation.			Cure.	
70	" Pers'l letter.		M.				Cure.	
71	W. A. Smith. Pers'l letter.	36	F.	Discovered during operation.	Excision.		Cure.	
72	Roswell Park,	39	. .	Annoying discharge from umbilicus.	Excision.		Cure.	
73	"	7	. .		"		Cure.	
74	" Pers'l letter.	2	. .		No operation.		Cure.	
75	J. F. Erdman,	Young	F.	Fixed tumor in abdominal wall.	Excision.		Cure.	
76	"	Adult	F.				Cure.	
77	" Pers'l letter.	Middle Age	M.				Cure.	
78	Howard A. Kelly,	27	F.	Burning sensation on urination with increased frequency in micturition for one year previous to operation, in first case. Slight pressure about rectum for two years previous to operation, in second case. Swelling in lower abdomen, without pain, in third.	Excision.		Cure.	Two were diagnosed before and one during an operation.
79	"	46	F.		Cyst grasped on its peritoneal surface, pulled out to develop a pedicle. This was snipped through with scissors. No sutures or ligatures needed.		Cure.	
80	" Pers'l letter.	25	F.		Cyst of urachus removed along with a piece of its pedicle.		Cure.	

TABLE OF CASES OF CYST OF THE URACHUS—*Continued.*

Case No.	Operator and Reference.	Age.	Sex.	History and Symptoms.	Treatment.	Character of Cyst Contents.	Result.	Remarks.
81	DeForest Willard,	Child	F.	Intermittent oozing of urine.	Plastic closure.		Cure.	
82	"	"	F.	Intermittent oozing of urine.	No operation.		Don't know.	
83	" Pers'l letter.	14	F.	Treated by family physician for two months for typhoid fever. Probably sepsis. When first seen had enormously large abdomen which had been distended for several weeks. The day previous to his first visit the umbilicus opened and several pints of pus discharged. No odor of urine and history gave no report of urinary discharge from umbilicus.	Wound in umbilicus enlarged and drained. The cavity healed after 3 months, and has since remained closed.	Pus.	Cure.	
84	E. Wyllys Andrews,	Young adult		All were small narrow sacks which gave no trouble and were accidentally discovered.	Treatment not stated.		Cure.	
85	"	Adult					Cure.	
86	" Pers'l letter.	"					Cure.	

The cases above tabulated represent the known clinical material as published up to this time, or at least all that a careful search revealed. The table contains in addition 28 cases which were secured by correspondence and which have not been previously reported (Cases 59 to 86).

The history of many of these cases as given is very meagre and some of them are of no clinical importance. I have, however, tabulated all of those secured by correspondence, although in most instances the data received is not sufficient to warrant a positive classification.

SEX AND AGE.

Of the 89 cases here tabulated, including the three of my own, there were twenty-one males, fifty-eight females, and seven in which sex was not stated.

That urachal cysts are more common in middle life (from 20 to 40 years), and that in adult life women are more frequently affected than men, is shown from the fact that in seventy-two cases where the age is given, thirty-four cases were between twenty and forty years of age. Twenty-nine of these were females and five males. Of fourteen cases under fifteen years of age an equal number were males and females, and of the remaining fifteen who were past forty, ten were females and five males. It was stated in five cases that the woman was pregnant at the time she presented herself for treatment.

HISTORY.

Perhaps the most constant factor in the history of this condition is a mass felt between the umbilicus and symphysis pubis, varying in size from a barely palpable mass to a very large tumor. The symptoms usually present are a feeling of illness, loss of flesh, pain, often fever, gastric disturbance, and indeed the appearance of a tubercular subject. In addition to these we have in 15 per cent. of cases a discharging sinus through the umbilicus.

Tait speaks of peculiarities in the percussion note.

Other phenomena resulting from attempts at diagnosis, bimanual palpation, tapping, etc., appear to be equivocal in character, excepting in the presence of polygonal epithelium in the sediment of the tapped fluid. This, if present, is said to be pathognomonic.

DIFFERENTIAL DIAGNOSIS.

This condition has been diagnosed as tubercular peritonitis, and to one who has not come in contact with urachal cyst it is a most pardonable error.

A large cyst of the urachus may be mistaken for a parovarian cyst or an ectopic gestation.

TREATMENT.

Tait's Technique is naturally depended upon largely in the treatment. Incision and drainage are the first essential. A large proportion of these cysts cannot be extirpated, and Tait used irrigation and mopping with iodine. In two of my cases I simply irrigated and drained, with good recovery.

The detached peritoneum is troublesome, but, as suggested by Douglas, may be sutured back to the parietes, the to omentum, or excised and spread over the gap.

REFERENCES.

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[2]Medico-Chirurgical Transactions, 1898, lxxvi, p. 301.
[3]Archiv für Heilk., Bd. xi, 1870.
[4]Inaug. Dessertation, Marburg, 1873.
[5]Ovarian Tumors, p. 50.
[6]Diseases of the Ovaries.
[7]British Gynæcological Journal, 1886-7, ii, p. 328.
[8]ANNALS OF SURGERY, xiv., p. 350.
[9]ANNALS OF SURGERY, 1887, v., p. 107.
[10]American Journal of Obstetrics, 1897, xxxvi, p. 472.

ON THE VALUE OF THE INDIGO-CARMIN TEST AS AN AID IN THE DIAGNOSIS OF PARTIAL AND TOTAL URETERAL OCCLUSIONS.

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DURING the past year three cases of obstruction of the ureter came under my care, and as the technique employed in studying them proved very adequate and simple, I have brought together in this paper the most essential facts bearing on these cases and their diagnosis.

Cystoscopy and ureteral catheterization are considered our main reliance in establishing the diagnosis of the patency or obstruction of a ureter. With the former the ostium of the ureter can be studied and frequently the observer can detect the systole and diastole of this slit, as well as the emission of a small stream of urine. By means of the latter the examiner can frequently determine an obstruction and locate its site. Both these aids are very valuable, but, as will be seen in the following cases, they were much less valuable than would have been expected *a priori* from a theoretical consideration of the problems involved.

In my cases I have supplemented the cystoscopic examination and the ureteral catheterization with the use of indigo-carmin to determine the patency of the ureter, and the results obtained have at times contradicted my diagnosis based on simple cystoscopy and ureteral catheterization; at other times the use of this coloring matter has verified my previous diagnosis. In the hypodermic administration of indigo-carmin in sterile concentrated aqueous solution, I see a most valuable aid in the diagnosis of the condition under consideration. Its use clears up many erroneous conclusions and prevents

some of the grossest diagnostic blunders, as will be made very evident in the following three cases:

CASE I.—F., aged 45 years. Had been sick for 1½ years. She was treated at several institutions in this city, without obtaining relief. She was finally operated, to determine the nature of a thickening of the right iliac bone, which thickening extended well into the right iliac fossa. The microscopic report of an excised piece of this bone was sarcoma, as the operator informed me by letter. About 6 to 8 weeks after this exploration she came into my care at the Sydenham Hospital with a 5-inch scar running obliquely downward and forward from the right lumbar region into the right iliac fossa. Several deep sinuses persisted, and from these a moderate amount of clear fluid discharged. Examination of this fluid showed it was not urine. The iliac bone was markedly thickened. Her urine was negative. Her general condition was very poor, suggesting cachexia.[1]

As I suspected there might be some ureteral or kidney condition underlying this marked thickening in the right iliac fossa, on November 16, 1905, cystoscopy and catheterization of the right ureter was done. The bladder was absolutely normal. There was no diastole and systole at the right ostium, and no stream of urine was seen coming from this ureter. Catheterization of the right ureter was easily performed, but one-half inch from the ostium the ureter was obstructed. A No. 7 F. catheter[2] was first used and then a No. 4 F. Both catheters were obstructed at the same level. Absolutely no urine escaped from the catheter while in place.

As far as I had investigated this case it seemed justifiable to conclude that I was dealing with an obstruction of the right ureter, and from the fact that there was no play at the right ureteral ostium, and that no jet was emitted, diagnosis of complete ureteral obstruction was indicated. To clear up matters more satisfactorily on November 24, 1905, a second cystoscopy and ureteral catheterization was done, with the identical results. At this examination I injected, hypodermatically, 30 minims of a concentrated aqueous indigo-carmin solution, and after allowing one-half hour to elapse I made a fresh cystoscopic examination. Much to my surprise I found that *from the right ureter a minute*

and exceedingly feeble jet of blue urine was discharged. From the left ureter a forceful and copious stream poured well into the bladder, with marked regularity.

This observation upset my original, apparently well-founded diagnosis of a complete right-sided ureteral obstruction. The discharge of the feeble minute stream from the right ureter absolutely demonstrated its patency and the small volume of the stream showed that the obstruction was sufficiently marked to permit of the passage of only small amounts of urine at a time.

Subsequently the patient was given the test of antisyphilitic treatment and with that her general condition improved markedly, the sinuses closed, and the greater part of the iliac bone thickening as well as the induration in the iliac fossa disappeared. To determine what if any effect this absorption of the diseased tissue had upon the patency of the right ureter, on February 5, 1906, another cystoscopy and ureteral catheterization was performed. The bladder was normal as before. No systolic and diastolic play was detected at the right ureteral ostium. The right ureter was then catheterized and a No. 5 F. was passed 8½ inches into this ureter without the least difficulty. The urine obtained by means of this catheter was absolutely clear and normal in every particular.

Epicrisis.—This case shows how easily one can be misled in the diagnosis of ureteral obstructions if one relies on the methods usually employed. Basing my views on them at the first examination, I thought I had to deal with a complete ureteral obstruction. By the use of indigo-carmin it was made very evident that this ureter was only partially occluded, which could not be determined in any other way either as readily or as simply. Moreover the size of the stained stream gave me some idea of the calibre of the stricture.

Case II.—M., aged 40 years. This patient I studied at the German Hospital. He came to the hospital for pyuria. His history gave no clew to the cause.

April 27, 1906, I examined his bladder and found that the mucosa was chronically diseased. At the right ureter I detected no play of the ostium and the same applied to the left ostium. The lips of the right ureteral ostium were slightly everted. No distinct stream was detected coming from either ureter. As

the right ostium alone showed something abnormal, and as patient's symptoms were more marked on this side, I catheterized this ureter. At 1½ inches from the ostium both Nos. 8 and 5 F. were obstructed in their passage. I apparently had an obstruction of this ureter, probably due to stone. The use of indigo-carmin, employed as in Case I, was resorted to and the subsequent observation of the ureteral ostia confirmed my diagnosis of an obstruction and added the information that this obstruction was complete. The stream from the left ureter was voluminous, forceful and normal in every way, whereas absolutely no sign of a blue-colored stream appeared at the right ureteral ostium.

Epicrisis.—In this case the injection of indigo-carmin made it evident that the right ureter was completely blocked, which diagnosis would have been absolutely impossible without this aid. Thus the facts elicited by these combined methods demonstrated the position as well as the degree of obstruction. *Neither method employed alone would have given the same results. As a diseased kidney may fail to excrete, or excrete very late, indigo-carmin, without the use of the ureteral catheter one might be misled to diagnose complete ureteral obstruction in such cases, though the ureter be patent. Thus it is clear that one method does not exclude the other and that both must be used together. The ureteral catheter will arouse our suspicions of an obstruction and the indigo-carmin test will verify or dispel these.*

CASE III.—F., aged 25 years. Patient is six months pregnant, and came to the Sydenham Hospital for bladder trouble. She has pyuria.

May 11, 1906, cystoscopy showed a highly congested and inflamed mucosa, with very marked œdema of the neck of the bladder. The organ was markedly flattened anteroposteriorly by pressure of the pregnant uterus. The ureteral ostia were normal and showed absolutely no play or discharge of urine. Both ureters were readily catheterized. The catheter was obstructed in its passage in the right ureter about 5 inches from the ostium; in the left ureter it was obstructed at about 3½ inches. Absolutely no urine was obtained from either catheter. Thinking the pregnant uterus might be pressing on the ureters, this organ was supported from the lumbar regions and drawn from the bladder, without result. Then the table was raised so

that patient's body was on an inclined plane, with pelvis raised; this was equally ineffectual. Patient was then placed in knee-chest position, and even in this position no urine flowed through the catheters. These manœuvres, however, seemed to indicate that the uterus was probably not the cause of the obstruction to the passage of the ureters.

The cystoscope (Nitze's double-catheter instrument) was then removed and after a fresh filling of the bladder a very rigid pair of ureteral catheters was employed. With these I succeeded in getting past the obstruction in the right ureter, but absolutely failed in the left ureter. The urine flowed very rapidly from the right ureter, so that I obtained some 20 ccm. in 6 to 7 minutes. This specimen was perfectly normal. The large amount of urine obtained showed a dilated condition of the pelvis and upper ureter.

A few days later I repeated the above examination, with identical results. After some trouble I obtained a copious discharge of normal urine from the pelvis of the right kidney, but failed absolutely on the left side. Meanwhile the pyuria was rapidly giving way to the systematic bladder lavage, so that there was no valid reason for further ureteral catheterization. As far as I had gone, it seemed justifiable to conclude that there were obstructions in both ureters. In the right the obstruction seemed slight, whereas in the left ureter it seemed absolute. Not satisfied with this result, and relying on the experience furnished by the two previous cases, on May 24, 1906, after an injection of indigo-carmin, I made another cystoscopic examination. To my great surprise, a copious, regular, forceful blue stream appeared at the left ureteral ostium. A short while thereafter a much more voluminous blue stream appeared from the right ureteral ostium. After this very voluminous discharge, a minute stream trickled out of the same ureter, as if it were squeezing out what had remained in the ureter by an aftercoming peristaltic wave—much as the descent of solids and fluids in the œsophagus. This very voluminous discharge was very irregular in point of time; while the left side was squirting two or three times a minute, the right side was absolutely quiescent for many minutes at a time.

Epicrisis.—In this case the indigo-carmin test cleared up the whole picture. It showed that the left ureter was absolutely patent and that the kidney was working well. On the right side

it indicated that there might be some distention of the ureteral tract as manifested by the enormous blue jet that was poured into the bladder, and it also showed that the obstruction was dynamic rather than organic.

The following conclusions seem justified by the experiences in the foregoing cases:

1. The cystoscopic study of the behavior of the ureteral orifices does not suffice for the diagnosis of ureteral obstructions.

2. The cystoscopic study of the ureteral jet, especially if the urine is normal, is equally insufficient.

3. Ureteral catheterization *per se* cannot determine for us the presence of ureteral obstruction.

4. Similarly the indigo-carmin test *per se* is as inadequate as ureteral catheterization *per se,* because though the ureter be patent indigo-carmin may not be excreted if the kidney under examination is diseased.

5. On the other hand in ureteral catheterization conjoined with the indigo-carmin test we have a very satisfactory method of determining the presence or absence of a ureteral obstruction as well as the degree of patency of the ureter, as shown in the above cases.

[1] Further details of her general condition are unnecessary as they have no bearing on the diagnostic points with which this paper is dealing.

[2] The catheters employed in these cases were fitted with lateral openings.

ARTERIOVENOUS ANASTOMOSIS.

BY JOSHUA C. HUBBARD, M.D.,

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Assistant Visiting Surgeon Boston City Hospital.

WHENEVER a new branch of surgery is entered upon a long time may be necessary before any one man can definitely decide from his own cases on its usefulness. Reports of isolated cases from different observers are here helpful. I therefore report the following case of arteriovenous anastomosis which is, I believe, one of the earliest, if not the first, in which the suggestion of Carrel and Guthrie [1] has been followed.

Dennis C., eighty years old, entered the service of Dr. George H. Monks, by whose kindness I was permitted to operate, at the Boston City Hospital the last of April, 1906. His history was of no special importance except that he had had heart trouble and had frozen his little toe the previous winter. He came to the hospital for gangrene of the middle toe of the right foot.

Physical Examination: Well developed and nourished. Heart, base second rib, apex in anterior axillary line under the sixth rib, loud systolic murmur transmitted to axilla. Pulmonary second sound accentuated. Lips blue. Radial arteries tortuous and all arteries markedly sclerotic. Abdomen negative. Left hydrocele. Middle toe right foot in condition of dry gangrene with œdema of foot to heel. No pulsation felt in dorsalis pedis. The urine was pale, acid, 1012, free from albumen, sugar or bile.

He was put upon appropriate treatment. The gangrene was kept dry but slowly progressed so that the middle toe sloughed off and the neighboring toes became involved in the process.

On May 10 under ether an arteriovenous anastomosis was done. The knee was flexed and the thigh rotated outward. An incision was made over the apex of Scarpa's triangle and carried down to the sartorius muscle, which was retracted outward. The

[1] ANNALS OF SURGERY, Feb., 1906.

sheath of the vessel was opened and the artery freed for about two and a-half inches. The vessel was decidedly sclerotic. The vein lying behind and slightly to the outer side was freed for a corresponding distance. This required ligation of two or three small branches. A Crile clamp was placed on the artery at the proximal end of the freed portion and a split piece of rubber tubing was used to control the circulation at the distal part. A Crile clamp was put on the distal portion of the vein and a rubber tourniquet on the proximal. The artery and vein were each divided, the vein at a slightly higher level than the artery to facilitate the first anastomosis. The proximal end of the artery was then invaginated into the distal end of the vein. Three double-headed mattress sutures, placed equally distant on the circumference of the artery, were passed through the wall from the inside out. The needles passed within the vein for about a quarter of an inch were pushed through its wall from inside out. When the sutures were tied the artery was invaginated into the vein. Interrupted sutures then caught the overlapping vein to the wall of the artery, the whole thickness of the latter not being included in the sutures. Pagenstecher's celluloid thread No. 1 was used for all these sutures. The distal control tourniquet was removed from the vein below the anastomosis and the Crile clamp from the artery above the anastomosis. There was absolutely no leaking at the joint. The vein promptly partially filled and pulsated slightly. By a similar proceeding the distal end of the artery was invaginated into the proximal end of the vein. As the vessels had been divided at slightly different levels to aid in the first anastomosis some tension was necessary to connect these ends. A small clot which had formed in the end of the artery was wiped out before the anastomosis was begun. During the manipulations of this anastomosis the controlling tourniquet was pulled off the lower end of the artery, allowing some blood to escape from the distal end of the artery before it was again controlled. This blood was very dark and corresponded exactly in appearance to venous blood. When the anastomosis was completed and the controlling clamp and tourniquet removed the vein partially filled. The sartorius was then allowed to resume its normal position. The superficial fascia was sutured with catgut and the skin with silkworm-gut. A dry sterile dressing and a spica bandage were put

on, holding the thigh flexed on the body to relieve tension on the vessels. The patient was fastened to a Bradford frame with pillows under the knee. The recovery from ether was good.

At first I was disappointed in the result of the first anastomosis, by which arterial blood was delivered by the artery to the vein by the failure of the vein to pulsate forcibly and to fill out to its full extent. This, however, is hardly to be expected for the possible calibre of the vein is much greater than that of the artery and its non-elastic walls would not transmit the pulsation. The fact that blood of venous appearance was in the lower end of the artery at the time of the second anastomosis may be explained in one of two ways; either the arterial blood had had time to go round through the veins and was trying to return as venous blood through the lower part of the artery, or the blood had been kept stationary in this portion of the vessel long enough to change in appearance. The blood was not dark-colored from the cyanosis of overetherization, for the patient at no time during the operation was more than lightly etherized. The fact that the vein filled after the second anastomosis, where the portion of artery which was expected to return venous blood was connected with the proximal end of the vein, seemed to me of importance, showing, I thought, some back flow up the artery.

After the operation there was no immediate change in the appearance of the leg. Its temperature was fully as warm as that of the other leg and there was no œdema. Some who watched the case thought as time went on that the superficial veins became a little more prominent than before the operation. The correctness of this observation I question. The veins never pulsated. The incision in the thigh healed by first intention in spite of the fact that the patient frequently tore off the dressing. The gangrene spread very slowly until the front portion of the foot, roughly that anterior to the tarso-metatarsal joint, became involved and here a line of demarcation formed. The patient was shown in this condition to those members of the American Medical Association who visited the hospital clinics and it seemed to be possible at that time to make the following deductions: Inasmuch as the circulation in the leg before operation was sufficiently poor to permit gangrene of the toes, and inasmuch as the femoral artery had been divided in Scarpa's triangle thus permitting

collateral circulation only through the profunda, it was fair to suppose that very little blood would have reached the lower leg through the collateral circulation and that the gangrene would rapidly have involved the leg unless as a result of the operation the veins were carrying the arterial blood. As the leg presented none of the appearances common to an extremity from which the blood has been shut off, and as the gangrene extended only very slowly finally forming a line of demarcation at about the tarso-metatarsal joint, the operation was considered to have been successful.

Amputation of course was necessary to remove the gangrenous portion of the foot. As an amputation at the point of election on the leg was considered preferable to one through the foot the leg was cut off on June 8. The operation was done without any tourniquet. Both anterior and posterior tibial arteries contained arterial blood which spurted out from the cut ends with fairly good force. The veins did not appear to contain any arterial blood. There was a slight separation of the skin of the flaps which left a very narrow area to heal by granulation. This required a rather long time and the patient was discharged on August 6.

What the meaning of the findings at the amputation is I do not know, and whether it vitiates all the deductions made earlier I must leave undecided. The case is reported simply as a case and each may draw his own conclusions.

PROSTATECTOMY IN TWO STAGES:

A CONSERVATIVE OPERATION WITH MINIMUM HAZARD.

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OF NEW YORK,

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It is not the object of this brief communication to present a novel operative technique or original method, but it is simply an observation of personal work performed during the past year in a class of cases of prostatic surgery which may be described as "bad risks," or those which go to make the mortality rate of any operator high.

Statistics of prostatic operations vary so widely, and opinions seem so to differ amongst many surgeons, that one is inclined to wonder what is the real consensus of opinion concerning the hazard of prostatectomy.

Each year this Association has listened to the splendid reports of its able members, and to the brilliant technique which has gradually reduced the mortality percentage of prostatectomy in the last decade at least at the rate of one per cent. per annum; yet it cannot be denied that in some cases it makes little difference how brilliant the operator or how perfect his technique, certain physical conditions exist which cannot be contended against.

Each case has its own personal equation comprehending the important features bearing upon it. Amongst these features of accepted importance we may cite the age and general vitality of the patient. It stands to reason that, other things being equal, statistics confined to patients seventy or eighty years old should show a relatively high degree of mortality. Again, the kidneys bear so important a relation to the immediate condition and future outlook of every prostatic about to be operated upon, that the greater the damage already to these organs

the less can they be expected to withstand any additional strain consequent upon operation.

The man who consumes a great deal of food without exercise runs to fat and has little resistive power generally, is a bad subject for infectious fevers, and likewise a poor subject for an operation of the nature of prostatectomy, on account of the resistance required against urinary absorption.

A man who, after a life of ease and comfort and self-indulgence, is visited in his advanced years by some great shock or business care of magnitude, has his resistive power much reduced by the trauma to his nervous system and is a poor surgical risk for prostatectomy.

If we sum up briefly the dangers and difficulties to be contended with in prostatic operations, as urinary suppression, secondary shock, and general toxemia, and in especially congested prostates—profuse hæmorrhage, the mortality rate or hazard should bear a more or less direct relation to the existence of these features in any given case.

No one will, by choice, operate in emergency; and it has been in connection with the emergency cases of prostatic surgery that I have been compelled to operate upon in the past five years that I have been impressed with the special value in these several instances of operating upon the prostate in two stages. So that for some time past it has become my practice, in a certain number of cases suggestive of high operative risk, to perform the work designedly in two separate stages rather than do a complete and radical removal at the first operation.

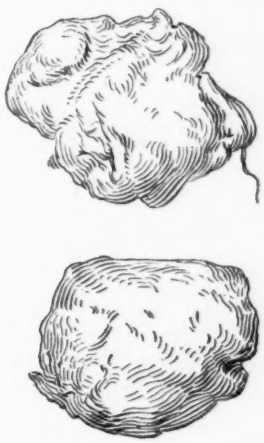
It has happened that within the past twelve months there have been about eight such cases, so severe in type and so threatening in character that in drawing statistics to determine the average rate of mortality they should be considered by themselves.

Yet the result in each instance has been so strikingly satisfactory that I have seen fit to select this theme for the subject of my communication to this Association, and submit these cases in evidence of the value of that particular kind of conservatism in the class of cases that they represent.

It may be claimed with some truth that several or all of these patients might have survived a radical operation in one step by suitable technique in the hands of a rapid and efficient operator; yet, as I scan the histories of these cases and reflect upon the personal impression gained at the time I analyzed the situation of each, I cannot but feel that had a different course been pursued, most, if not all, of them would have succumbed; and whereas, even if a few of them had not done so, the risk of radical primary operation would certainly have been greatly increased.

CASE 1.

CASE 3.



The following is an abstract of the important features bearing upon the histories of each case:

CASE I.—D. D., aged 80. February, 1905. Usual symptoms of prostatism. *Urination.*—Every one-half to one and one-half hours, day and night. *Pain.*—During and after urination, and burning during exertion both in the glans penis and epipubic region. *Urine.*—Turbid, purulent, foul and ammoniacal.

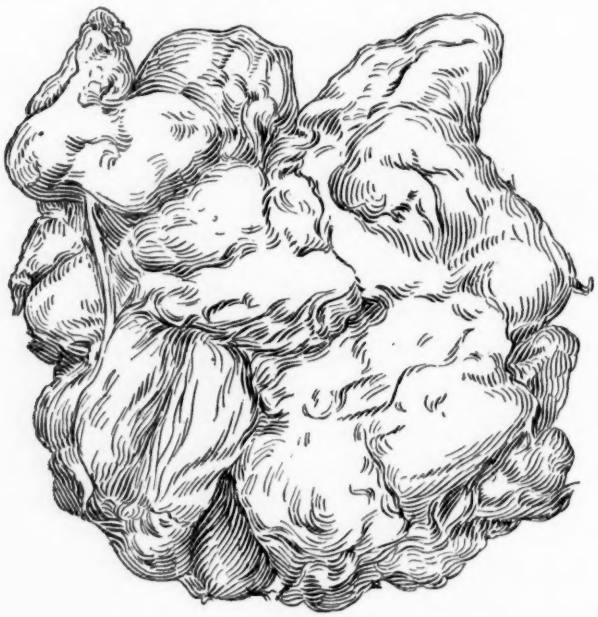
General Condition.—Feeble and shows evidence of urinary toxemia,—tongue dry, breath fetid, etc.

Previous History.—Patient has never had complete retention, but has on several occasions attempted to relieve himself by the use of a catheter. His doctor states that his urine was perfectly clear up to six months ago.

Examination.—Prostate *per rectum* moderately enlarged. Urethral length, 7 inches. Residuum, 1½ oz. Search for stone, negative. Concentric, intravesical, moderate prostatic growth is felt with searcher.

February 8, first operation. Perineal cystotomy. Digital exploration finds a circular and symmetric prostatic growth. One galvano-cautery incision enlarging the vesical orifice, and a drainage tube inserted.

CASE 4.



February 17, second operation. Two portions of prostatic tissue the size of a large English walnut are removed through the perineal wound and prostatic urethra. Hæmorrhage promptly and effectually controlled with formaldehyd gelatin and packing.

Patient out of bed on third day after removal of prostate. On account of age convalescence is slow, but ultimate progress entirely satisfactory.

Last observation one year after operation. Patient empties bladder completely, retaining urine for from two to four hours, and is in excellent general health.

CASE II.—B. G., aged 53. May, 1905. Usual symptoms of

prostatism. *Urination.*—From one to two hours by day and five or six times at night. *Pain.*—Great smarting during and at the end of urination. *Urine.*—Turbid; purulent. Laboratory examination shows albumin in marked quantity and epithelial casts.

General Condition.—Poor. Patient is flabby and soft; takes no exercise; eats excessively; dyspeptic, constipated, neurotic.

Previous History.—Duration of trouble over ten years, beginning with stone in the bladder, with acute retention; since when symptoms have become gradually worse and kidney implication progressively increased.

Examination.—Prostate *per rectum* bilaterally enlarged; urethral length, 8 inches. Residuum, 3 ounces. Search for stone, negative. Searcher distinguishes moderate, intravesical abutment and a median bar.

May 8, first operation. Preliminary perineal drainage. Intravesical exploration feels a very tight urethral orifice and general circular hypertrophy of prostate.

May 15, second operation. Galvano-prostatotomy. Two cuts, one on each side, one centimeter in length. Hæmorrhage promptly and effectually controlled by formaldehyd gelatin and packing. Drainage renewed for three days. Patient leaves hospital at the end of two weeks. Ultimate progress satisfactory.

November 14, 1905.—Last observation, six months after operation. Patient empties bladder completely. The urine is opalescent but perfectly sweet. Urination every two to four hours. Still some albumin in urine. General condition much improved.

Case III.—J. A. C., aged 79. November, 1905. Complete retention, which has existed for four years. Catheter has gone with increasing difficulty and size has been reduced until one with stylet has become necessary. Finally, for several days urethra has closed entirely and his attendant physician has been called in to relieve him by aspiration. *Urine.*—Muco-purulent; ammoniacal.

General Condition.—Poor. Pulse irregular; tongue coated.

Previous History.—As above stated, catheter life for four years; prior to which the usual symptoms of prostatism were in force.

Examination.—Prostate *per rectum* rounded, succulent, congested, about the size of a golf ball. Urethral length, 9 inches.

November 10, first operation. Preliminary perineal drainage. Patient stands operation poorly but reacts satisfactorily.

May 17 (one week later), second operation. Two large prostatic lobes removed through the granulating perineal wound, after preliminary galvano-cautery incision of vesical orifice, which is very tight. The obstruction in this case is found to be twofold —a tight vesical orifice and lateral compression of the prostatic urethra by the two lobes, which are removed. Hæmorrhage promptly and effectually controlled with formaldehyd gelatin and packing.

Seventeen hours after operation, patient is reading the daily paper. Four days later, tube removed and urination through perineal wound.

Seven days after operation patient is out of bed. Subsequent condition progressively satisfactory.

Last report, one year after operation. Patient urinates voluntarily without catheter at intervals from three to four hours; bladder empties perfectly without pain; general condition excellent.

CASE IV.—A. J., aged 77. December 8, 1905. Emergency case. Complete retention of urine; copious intravesical hæmorrhage caused by attempt at catheterism outside of hospital.

General Condition.—Great distress and pain, due to bladder distension. Pulse rapid and irregular.

Previous History.—Only previous attack of hæmorrhage one year ago, without apparent reason. Otherwise usual symptoms of prostatism, gradually increasing in intensity for years.

Examination.—Prostate *per rectum* much enlarged, rounded, tense, congested. Bladder felt above the pubis, reaching between it and the umbilicus.

Operation.—Suprapubic cystotomy late at night; bladder full of blood-clots and urine; great bleeding during operation from congested prostate. Bleeding recurs with great activity and, twenty-four hours later, tube inserted through perineal opening. Hæmorrhage is promptly and effectually controlled with formaldehyd gelatin and packing.

For two weeks following, condition very critical; patient is evidently toxemic. Kidneys, however, secrete freely; muttering, and at times violent delirium. The toxic state gradually improves and wounds develop healthy granulations.

December 29, three weeks after preliminary operation, perineal prostatectomy. A large amount of adenomatous tissue removed through perineum; hæmorrhage not great; reaction slight. Bladder drains by perineum and suprapubic wound closed. Packing out in forty-eight hours; patient out of bed at end of week. All urine comes through perineum by voluntary urination ten days after operation. Subsequent progress entirely satisfactory. Last report, five months after operation. Patient walking about the streets; urinates voluntarily without difficulty; empties bladder; general health entirely satisfactory.

CASE V.—J. W. A., aged 67. January, 1906. Usual symptoms of prostatism, with increasing irritability. *Urination.*—Every two hours day and night, with attacks of greatly-increasing frequency. *Pain.*—Smarting and irritability, associated with the urinary act and between times. Urine.—Turbid, purulent, sometimes ammoniacal. Bacteriuria, albumin and casts.

General Condition.—Medium. Patient is under a great nervous strain. Flesh soft and flabby; eats freely, and is dyspeptic and constipated.

Previous History.—For ten years there has been increasing evidence of vesical obstruction. The stream has gradually become smaller and urination more halting at the start.

Examination.—Prostate *per rectum* symmetrically and bilaterally large; urethral length 8½ inches; residual urine 3 ounces. Search for stone, negative. Following search there is great increase in the bladder irritability, and decided constitutional disturbance in the shape of chill and fever, etc. The symptoms of vesical irritability and obstruction continue to increase progressively, with a varying degree of intensity. Operation determined upon. On account of the great mental depression and of the poor general physical condition the patient is regarded as a questionable risk, and it is decided to approach the operation in two stages.

February 15, 1906, preliminary perineal cystotomy. Hæmorrhage from the congested prostate is unusually marked. The perineal distance is very long and the patient is kept under operation only long enough to make out a symmetrically enlarged prostate encircling the bladder orifice and compressing the prostatic urethra. Although this preliminary procedure required but a few moments, the shock of anæsthetic and operation is most dis-

proportionately intense. A few hours after operation, the pulse drops suddenly from 100 to 60, becomes very feeble, and there is marked postoperative shock. The patient rallies under morphine and stimulants. Drainage instituted for one week.

CASE 5.

CASE 6.

February 22, second operation. Both lateral lobes and median isthmus are enucleated through prostatic urethra. Hæmorrhage promptly and effectually controlled by formaldehyd gelatin and packing. Perineal tube is reinserted. The shock from this secondary operation is as disproportionately slight as that after the first operation was disproportionately great. Perineal tube out in six days. Return to voluntary urination through urethra pursues the usual course. Bladder empties entirely. Irritability grows progressively less. Progress is delayed by the intervention of a swollen testicle due to catheterism. Some involuntary dribbling continues for a few weeks but later subsides.

Last report, two months after operations. Bladder empties perfectly. Urinary intervals three to four hours. Practically no irritability. General health markedly improved, and patient starts for European trip.

CASE VI.—W., aged 69. February, 1906. Usual symptoms

of prostatism. *Urination.*—Frequency and urgency; difficulty in starting stream; intervals from every one-half to every three hours by day and once or twice at night. *Pain.*—Pain and discomfort in testicles and perineum during urination. *Urine.*—Turbid and purulent; not ammoniacal.

General Condition.—Fairly good.

Previous History.—Retention two years ago, when catheter was used several times daily for two months.

Examination.—Prostate *per rectum* moderately large; urethral length 8 inches. Search for stone, negative; searcher arrested at vesical orifice by contracture or bar.

February 16, preliminary perineal drainage. Prostate uniformly enlarged; small middle lobe and bilateral hypertrophy.

February 23, two lateral lobes and median isthmus enucleated through the perineum. Hæmorrhage promptly and effectually controlled with formaldehyd gelatin and packing.

Patient up at end of week; out of hospital in two weeks. Subsequent progress satisfactory.

Last observation, two months after operation. Bladder empties perfectly. Urination slightly more frequent than normal, but intervals gradually increasing.

CASE VII.—J. G., aged 65. March, 1906. Usual symptoms of prostatism. *Urination.*—Great difficulty, frequency and urgency; every hour day and night, sometimes more frequent. *Pain.*—Not marked. *Urine.*—Turbid and purulent; not decomposed.

General Condition.—Corpulent, flabby, soft, lymphatic.

Previous History.—For four years the urinary difficulty had gradually grown and increased, the stream gradually becoming smaller and the sense of insufficient emptying of the bladder more evident. Latterly there had been nocturnal and diurnal incontinence.

Examination.—Prostate *per rectum* enlarged to triple the normal size; consistence, succulent and compressible. Urethral length 8 inches. Search for stone, negative. Bilateral intravesical encroachment of prostate; residuum 17½ ounces.

March 6, preliminary perineal section. Following this simple procedure the reaction was disproportionately great. There was much febrile disturbance. The patient passed through a critical

period for the first ten days following the perineal drainage, when it was out of the question to consider the second operation. The temperature ranged from 103° to 104°, accompanied at varying intervals by chill. Under bladder lavage and internal antiseptics the toxemic condition gradually subsided, but there continued to exist an evening rise in temperature.

March 20, two weeks after the primary operation, perineal prostatectomy was performed. Two large lateral lobes were removed through the prostatic urethra. Hæmorrhage promptly

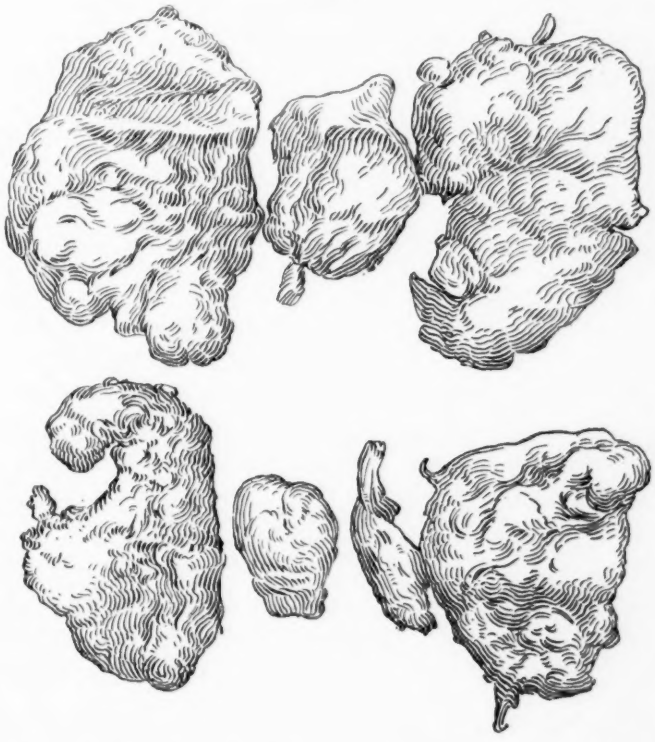
CASE 7.

and effectually controlled by formaldehyd gelatin and packing. Immediate reaction very slight after this operation. Subsequently double orchitis occurred, confining the patient to bed for an unusually long period. The subsequent condition has been sluggish; the wound is healing very slowly, and in every phase of the case there is confirmatory evidence of the unsatisfactory material of the patient. Last observation, two months after operation. Patient is out of bed and about, but still in unsatisfactory general physical condition. Perineal wound has not entirely healed, and there remains some leakage between the urinary acts, which are about from one to two hours. Yet there is slow but progressive improvement of the bladder, the general

condition and the dribbling, and it would seem that ultimate recovery is only a question of time.

CASE VIII.—W. B., aged 70. April, 1906. Patient was brought to the hospital as an emergency case, having suffered outside the hospital for several days from retention, which had been relieved by aspiration. At the time of entrance bladder was greatly distended above the pubis and patient was suffering intensely. A catheter introduced by one of the assistant staff far

CASE 8.



enough to draw urine obtaining no return and being clogged with blood, further attempts had been discontinued.

General Condition.—Shows the evidences of urinary absorption. Tongue dry and coated, breath fetid.

Previous History.—Patient has shown the usual symptoms of prostatism for a number of years; the present is the first attack of retention.

Examination.—Urethral length uncertain. Prostate *per rectum* symmetrically enlarged, soft and resilient, giving the feel of the presenting body of waters during pregnancy.

Operation, April 24, 1906. Suprapubic incision, which discloses infiltration of urine in the prevesical region, presumably from the aspirating puncture, as no rent in the vesical wall could be found. The bladder when opened is found full of blood-clots and urine. The bladder is tremendously engorged. Perineal opening is made for drainage.

Patient's subsequent condition is very bad. Toxemia marked. Delirium supervenes, and febrile condition continues for a week or ten days after operation. Blood examination shows secondary anemia.

May 7, two weeks after first operation, secondary operation. Prostate removed through perineal opening by the assistance of finger through the suprapubic wound. This is found very helpful, on account of the unusually long distance of the perineum. Hæmorrhage promptly and effectually controlled by formaldehyd gelatin and packing. On account of the occurrence following the first operation of right epididymo-orchitis, a vasectomy is performed at the same time as the second prostatic operation. Reaction after operation is very slight and the vesicle which, prior to vasectomy, had been tender and enlarged, shows immediate and progressive improvement.

Last observation, two weeks after operation. After-condition of the patient has been sluggish on account of his enfeebled condition. He is, however, daily improving. The suprapubic wound is healing progressively and leaks very little. All of the urine comes through the perineum. There has not as yet been any voluntary urination, but patient sits up out of bed and is daily regaining strength.

A summary of these cases shows that the ages of the patients were, respectively, as follows: 80, 53, 79, 77, 67, 69, 65, 70, the average being threescore years and ten. Two of them, in the neighborhood of 80 years, were exceedingly feeble, and were considered questionable risks on this score. One gave evidence of advanced renal implication. Three others were emergencies, in that they had for several days suffered from acute retention relieved by aspiration. One of these had infil-

tration of urine in the prevesical region and two of them intravesical hæmorrhage. Three other patients were soft, flabby, neurotic, and more or less broken down in health, and would be classified as poor surgical risks on this account. All of them were submitted to complete radical removal of the prostate, after preliminary drainage, with one exception, in which instance, on account of the serious kidney complication, the galvano-cautery technique was employed. All of them up to the present have done remarkably well, the last reports dating from several weeks to twelve months after operation.

In recalling the important features of these cases I would lay particular stress upon the great value of formaldehyd gelatin as a local hæmostatic. It is my custom to employ it after all perineal operations, and since its use I have never had serious hæmorrhage and believe that as a result, the postoperative condition has been more peaceful to the patients and less troublesome. The drainage by tube has been more continuous and unobstructed and, generally speaking, there has been great freedom from that very aggravating and disturbing feature of straining with attendant bleeding and clot-formation which, in my past experience, had made so many perineal cases during their postoperative stage arduous, vexatious and even alarming.

Further observation upon the secondary operation is the incontestable fact that the parts, owing to circulatory decongestion and granulation, are much more accessible and the line of cleavage between the prostatic tissue and the capsular surrounding more easily separated; hæmorrhage is unimportant; shock is trifling, the operative period being minimized to a few minutes; and, finally, that much-feared after-condition of postoperative toxemia is almost entirely eliminated, as the patient during the preliminary period of drainage has become inured by his own secretions and his normal resistance fortified by the hand of nature in advance of and in preparation for the concluding operative procedure.

THE FEMALE PROSTATE.

AN ANATOMICO-SURGICAL STUDY.

BY CHARLES E. BARNETT, M.D.,

OF FORT WAYNE, IND.

FROM the hypothesis that the prostate in the male arises as two separate glands, which are developments of the lining membrane of the first port of the urethra, instead of the Müllerian duct-coalescence-embryologic idea, gives the female the opportunity for a like glandular development. So in order to call a closer attention to the subject of the deep urethral (Skenes) glands of the female, I have dubbed them, in the title of this paper, the Female Prostate.

In substantiation of the claim "that the male prostate has an entirely distinct and different origin from that of the utriculus masculinus," and thus allowing, in the writer's opinion, the analogy between the male prostate and the female deep urethral glands, the following points in embryology are offered as evidence:

"In the male the utriculus masculinus (the coalesced Müllerian ducts) enters the back of the first part of the urethra (the uro-genital sinus) in the middle of the line, and the vasa deferentia (the Wolffian ducts) terminate, in the edge of the orifice of the utricle, on either side.

"In the female the vagina (the coalesced Müllerian ducts) enters the back of the vestibule (the uro-genital sinus) in the middle line, and the ducts of Gärtner (the Wolffian ducts) terminate in the lower part of the vagina on either side.

"The homology between the male prostatic utricle and the female uterus and vagina is a demonstrable fact.

"The male prostatic utricle and the female uterus and vagina have an origin distinct and different from that of the uro-genital sinus.

"The prostate glands are developed in the wall of the genito-urinary sinus, at a point farther from the bladder than the opening of the utricle. They are apparently mucous glands of the uro-genital sinus, and they consist, in the fourth month, of a few branching columns of cells which cluster together at the back of the urethra, where they are seen in two separate masses, one on each side of the middle line. At this stage they are entirely within the layer of voluntary muscle of the urethral wall, and do not form any visible projection. In the ninth month they are larger, more fully developed, and form visible projections; they are two separate and distinct glands, and have grown beyond the limits of the external wall of the urethra."—Richardson.

It would seem from a study in comparative anatomy that the prostate gland, Cowper's glands, and the vesiculæ seminales (glands)[1] furnish the culture media for the sperm cell in the male.

Would it be straining a point too far to consider the female accessory glands, viz., the deep urethral, Bartholin[2] and Nabothian as secreting a still further culture media for the spermatozoa,[3] active if the male is passive and performing a greater function than a mere lubricant during coitus.

It is claimed as an undoubted fact that we have "the orgasm with discharge of semen in the male and the orgasm and reception of semen in the female." (Lydston.) The smaller mucous glands in the male are pouring out their fluid during the exciting stage of passion, we will say for the purpose

[1] Piersal finds glandular tissue in the vesiculæ seminales.

[2] The comparison between Cowper's glands and the glands of Bartholine is good. They both lie just below the bulb, within the triangular ligament, upon the levator ani or constrictor urethra muscle, as it is called, in this region. Their size and lengths of ducts are practically the same.

[3] Stöhr's Hystology, Fifth Edition, says: "In this mixture of fluids (*i.e.*, spermatozoa plus vesicular, prostatic and Cowper's gland fluid) the motions may continue for from twenty-four to forty-eight hours after death, and *for a still longer period in the secretions of the female genitalia.* * * * * Acids suspend motion, while animal fluids of alkaline reaction restore motion." This would tend to show that there was a secondary flow in the female that was sufficiently alkaline to neutralize the ordinary acid vaginal mucous.

of lubrication, but not so with the larger ones until the orgasm occurs.

From the limited investigation that the writer has been able to make there is a like functionating condition present in the female, with the difference that the simple mucous primary flow is greater than in the male and the secondary special flow with orgasm is not so profuse.

Observations on the chemistry of semen have been so few and fragmentary in character that the writer was not surprised not to be able, after considerable search, to gain any information relative to the chemistry or physiology of the female accessory-glandular fluid.

The study of the anatomy of the bladder and bladder-appendages has never been more active than to-day, and it is not impossible that some things have been overlooked by our older anatomists on account of their non-importance heretofore.

The new anatomies are giving the deep urethral glands of the female a passing notice, while the older ones are silent on that subject. Our recent works on the surgery of the urogenital tract of the female are further advanced even than the more recent anatomies in their anatomic description. This shows that the subject courts farther investigation.

The writer has found, after having made a number of female bladder dissections (the last ones being made in Weichselbaum's Pathologic Laboratory in Vienna), that the deep urethral glands of the female were located midway between the neck of the bladder and the meatus urinarus externus; placed laterally to the urethra, above the vesico-vaginal fascia, and having ducts which empty just internal to the external meatus. When hypertrophic the gland encroached upon the bladder-neck, the changes in shape during hypertrophy being similar to the male prostate during its outcroppings of lobules. (See Fig 1.)

In the majority of gonorrhœas of the female the urethra is invaded. During this urethritis the deep urethral glands are constantly in danger. Should they become infected the pathology present is much similar to gonorrhœal prostatitis

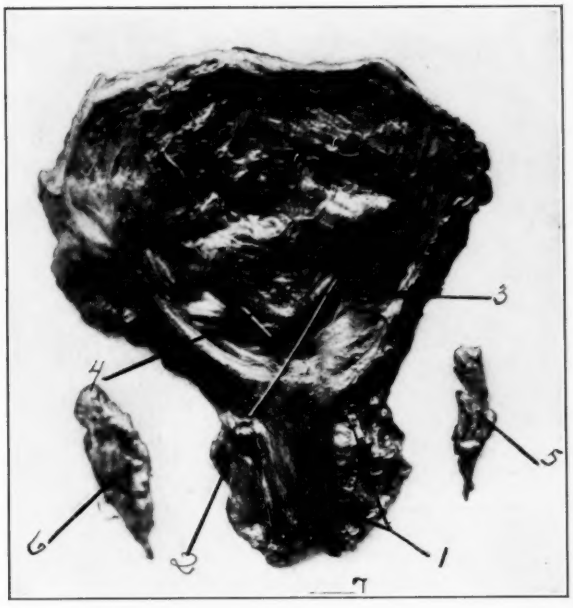


FIG. 1.—1, left hypertrophic gland; 2, right glandular lobule that acted as bolt valve in urethra; 3, wires sounding left urethral; 4, same in right urethral; 5 and 6, left and right hypertrophied gland of Bartholin; 7, tiny probe in duct of deep urethral gland.

in the male. Should pus form and the abscess break, the solution of continuity will either be toward the urethra or toward the vagina. Should the vaginal route be taken, there is great danger of an urethro-vaginal fistula, which is practically a vesico-vaginal fistula.

The vesico-vaginal fascia is so thin and so lacking in tone quality that an abscess penetration of it is effected with no great effort. Should the urethra remain competent the drainage opening will close and the abscess will reform *ad libitum* until surgical help is called. Should this infection be not sufficiently virulent to produce a breaking down of the tissues, there will remain a passive inflammation that by the stimulating effect within the acinus will produce an hypertrophy of the glands.[4]

The usual cases come late to the surgeon. Should there be sufficient time to abort suppuration, the best procedure, in the writer's opinion, is to slit the ducts to the glands and cauterize the field with silver nitrate.

If suppuration is present, the abscess should be opened from the vaginal side and properly drained. After resolution has taken place if any glandular remnants remain they should be taken away during the interval between the inflammatory crises, thus giving the operator a chance to avoid urethro-vaginal fistula. In case of urethro-glandular fistula, cauterization of the fistulous tract and abscess cavity should be done, followed by an interval operation, if possible, after the urethra has healed.

In vesico-vaginal fistula a plastic operation with the removal of all glandular remnants is indicated.

In all of these cases the bladder-neck will be found inflamed and will need attention.

The writer sees no reason why hypertrophy should need surgical attention unless it should happen to be like the case illustrated. Even with that condition present, the Fenwick

[4] See writer's article on Pathologic Changes Resulting from Prostatic Enlargement. American Medicine, April 8, 1905.

operation (with the large urethral specula for the removal of papillomatous growths in the bladder) could be utilized for the removal of the glandular lobule.

The report of three cases will give an idea of the kind of cases encountered by the surgeon that are due to inflammation of these glands:

CASE I.—Mrs. "X." Operated by the writer several years ago for kidney stone, with recovery. About a year following operation she was infected by her husband with gonorrhœa. On account of her innocence and unsuspecting disposition the writer was called late, and consequently got the sequela of the disease, which in this case was an acute adenitis of the deep urethral glands. Under treatment the inflammation subsided to a marked degree, leaving a passive inflammation with tenderness and some enlargement in that region. An operation for the removal of the glands was suggested, which was declined by the patient. The fact is the patient is not aware of the cause of her trouble, and, unfortunately for the writer, considers that it is a remnant of her old kidney trouble.

CASE II.—In consultation with a doctor of our city, Miss "Y." was examined. She gave a history of acute inflammation at the neck of the bladder; emphatically denied gonorrhœal infection. She was ordered to the hospital, where a vaginal examination was made, at which time a slide was smeared with pus milked from the deep urethral glands. The pus contained Nisserian diplococci; a cystoscopy was done the next day; neck of the bladder found highly congested; bladder washed and neck painted with silver nitrate; ducts of glands slit and cauterized with silver nitrate. Two weeks after leaving the hospital there was a recurrence of the adenitis, with suppuration. A cutting operation for drainage, followed by the removal of the glands, during interval, was suggested—which suggestion caused the discharge of both the attending physician and the writer. From us she passed to the care of a thoroughly competent practitioner, who called in a surgeon, who was also thoroughly competent, but they failed to find the true cause of the trouble, and from these men the patient has drifted until finally on account of their flowery promises, she has been attracted to the Osteopaths and the Chris-

tian Scientists. As this disease is entirely out of their spheres, the writer would not be surprised, at no distant date, to have the patient return for the surgical relief that was advised in the beginning.

CASE III.—Was called to Detroit to see Mrs "Z.", who gave a history of infection of deep urethral glands seven years ago, which was followed with abscess formation. Vesico-vaginal fistula followed the breaking of the abscess, leaving an opening larger than would admit one finger. She had been operated five or six times by competent surgeons for closure of fistula, with negative results.

The writer proposes, in endeavoring to close the fistula, in this case, to do a suprapubic cystotomy in two sittings. After cleaning the bladder thoroughly, to freshen the edges of the fistula, close same tightly with chromicised catgut, then cover over the whole fistulous region with a flap composed principally of the bulb of the vagina, patient being put to bed, lying on her belly, in order to drain the urine away from the wound. Should the closure be complete a urethral canal will be tunneled at another sitting.

TERATOMATA OF THE INGUINOSCROTAL REGION.[1]

INCLUDING A REVIEW OF REPORTED CASES.

BY DAVID C. HILTON, M.D.,
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TERATOMATA are tumors of peculiar mixed histologic composition. Every class of tumor is composed of a single representative tissue-element, derived in embryo from one of the germinal layers,—epiblast, hypoblast, or mesoblast.

Teratomata are described by several authors as tumors containing tissues, organs, or systems of organs, derived from two or all of the germ-layers, the highest type being a fœtus in fœtu. In such tumors we may expect to find epidermis and its appendages, squamous mucous membrane, teeth and nerve elements, etc., representing the epiblast; bone, cartilage, connective tissue, muscle, etc., representing the mesoblast; columnar and ciliated epithelium in gland or membrane formation, representing the hypoblast.

Many tumors classified as teratomata, however, do not correspond in embryologic origin or in histologic composition to this description.

As to embryologic origin, many dermoid and other cysts commonly classified as teratomata take their origin from one germ-layer only, instead of from two or all of these layers. For instance, dermoid cysts whose wall is essentially composed of epidermis, hair, nail, epidermal glands, and teeth, and whose content is made up of epidermal detritus and gland secretions, are epiblast in origin, and possess no representative of the other two germ-layers, unless the connective or areolar tissue-layer external and contiguous to the epidermal structure is an essential part of the neoplasm. This connective-tissue layer as an increment to the cyst-wall has not been dem-

[1] Read before the Nebraska State Medical Society, May 3, 1906.

onstrated to be neoplasmatic in origin or growth. It appears to be adjacent tissue that has become displaced, rearranged, and adherent to the cyst-tissue proper during its actual growth. Many echinococcus cysts possess a similar connective-tissue layer which is not of the parasite, but of the adjacent tissue of the host.

As to histological composition, many dermoid and other cysts classified as teratomata present no complex of tissue elements. For instance, some dermoids are described as being composed of epidermis, there being no other tissue-elements from the epiblast or other germ-layers.

The series of teratomata herein set forth includes twenty-six dermoid cysts, which, according to descriptions of contents, are strictly ectoblastic in origin, containing epidermis and its appendages, and sometimes teeth. Also two cases of sebaceous cystomata appear, representing a differentiated type of epidermal cell, a simple tissue-element.

Only recently have anatomists and surgeons turned their attention to this form of tumor.

According to A. Pabeuf (03), the first mention of such a tumor was made in the year 1666. Verneuil states that Duverney described at that time a "mass in the testicle which had the form of a fœtus." Another supposed case was attributed to Schroekius Brothers. The first thoroughly authentic case, however, was a teratoma of the right testicle, the size of a cocoanut, containing "bone, cartilage, oil, and flesh," reported orally by St. Donat in 1697. To Geoffrey St. Hilaire the credit is due of having placed the study of these peculiar neoplasms upon a scientific basis, in the early part of the last century, by proposing the abdominal-inclusion theory as an explanatory hypothesis. The number of reported cases has not been completely enumerated in previous reviews of the literature. Kocher made a report of fourteen cases of scrotal teratomata, and Pabeuf (03) of forty-seven cases of scrotal and testicular teratomata. I have collected seventy-nine cases from the inguinoscrotal region, excluding doubtful cases reported before 1697.

The distribution of the reports in time is as follows:

1600—1700	1
1700—1800	0
1800—1850	9
1850—1890	23
1890—1906	46

It is noteworthy that seventy-five per cent. of all recorded cases have been reported within the last twenty-five years. This is accounted for in the rise and popularization of aseptic surgery, coincident with which more of this class of patients have sought a radical cure.

The point of origin may be referred in forty cases to a testicle; in twenty-one, to the scrotum; in fourteen, to the inguinal canal or cord; and in one, to the tunica vaginalis testis. In three cases, the point of origin cannot be ascertained. In cases wherein the tumor invaded two or more groups of tissues, those parts which are the more dependent or are continuous with more compact tissues by layers of fascia, are taken to be secondarily invaded. On the contrary, the less dependent, more compactly constituted tissues are taken to be the point of origin or primarily-invaded area.

The size of the tumors varies considerably. The majority of them are not larger than a hen's egg. The largest recorded size is 22 by 23 cm.; the smallest is 1 by 1.2 cm. In several instances no size is definitely recorded.

The age of the patients presenting these tumors is distributed promiscuously from five months to sixty-four years.

The diagnosis of these tumors is usually comparatively easy, but sometimes very difficult. As to physical consistency, on palpation they are firm, or soft and doughy, depending on the character and quantity of contents. They are, with few exceptions, cysts. Some contain fluid substance—*i.e.*, oil secreted by sebaceous glands. Others contain solids or solid particles mingled with a varying amount of fluid, making a mealy bran-like mass, which is doughy and inelastic, pitting on pressure. The solid material is desquamated epithelium, hair, and sometimes teeth, cartilage, and bone.

With the exception of sebaceous cysts, which are often multiple in or adjacent to the integument along the median raphe of the perinoscrotal region, the tumors are usually single.

As to differential diagnosis we have to distinguish them from other neoplasms benign and malignant, from parasitic cysts such as cysticercus, from granulomatous masses such as syphilitic, tubercular and actinomycotic swellings, from serous and sanguinous exudates such as hydrocele, hæmatocele, and hæmatoma of the tunica vaginalis testis, scrotum, or spermatic cord, from suppurative inflammatory swellings, and from inguinal hernia.

From among those pathologic conditions that may simulate teratomatous cysts I shall select two for detailed consideration, viz., inguinal hernia and hydrocele of the spermatic cord. Cystic teratomata invading the inguinal canal may be very difficult to differentiate from the two conditions mentioned.

As to herniæ: those which are completely reducible or tympanitic on percussion because of gas present in the contained bowel are not to be confused with teratomata. On the other hand, herniæ not completely reducible and containing omentum may resemble in detail teratomatous tumors of the type of dermoid cysts. On inspection, both form rounded swellings dilating the external inguinal ring. On palpation, both have a peculiar doughy feeling, being soft, and pitting on pressure. Dermoids are of more uniform consistency, however, herniæ containing omentum often exhibiting firm nodules in the general mass. Dermoids, containing mostly fluid, are firm and elastic and of uniform consistency, thus differing from the type of hernia under consideration. On percussion, both reveal dulness. Thus we may find signs on examination very similar in both conditions.

The history usually reveals a difference in the development of the two conditions. Irreducible or partially reducible herniæ usually give a history of former reducibility. In case of dermoids, the tumor is never actually reducible. The patient may say that it is or has been reducible, because displacement of the swelling upwards and inwards with the finger past the ex-

ternal inguinal ring has been possible. My patient was very positive that he could formerly reduce the swelling.

As to hydrocele of the cord, we have a lesion that may resemble a cystic teratoma containing fluid.

The details of differential diagnosis may be succinctly put as follows:

History.—Hernia. Slowly developed (excepting congenital hernia). Development from above downward. Gradual increase in size. Common to all ages. Reduction of mass through inguinal canal possible in early course, if not at time of examination.

Teratoma of Inguinal Region.—Same as above, except that complete reduction is never possible. History of reducibility of the tumor may be given, because in some cases the tumor can be displaced upward through the external inguinal ring.

Hydrocele of the Cord. Same as above. Reduction impossible. Moves with cord.

Inspection.—Hernia. Smooth, rounded mass, bulging the external ring. If reducible, may be seen to disappear through the external ring.

Teratoma of Inguinal Region.—Similar in appearance and position. Seen to partially disappear on pseudo-reduction, in favorable cases.

Hydrocele of the Cord.—Smooth, rounded mass on the cord. Does not disappear on attempted reduction.

Palpation.—Hernia. Such as contain intestine are even, and may be soft or somewhat elastic, due to gas in the bowel-loops. Tremor imparted by movement of gas may be discernible.

Such as contain omentum and other solid structures are soft, even, or lumpy and inelastic, pitting on pressure. Testicle is below the swelling.

Teratoma of Inguinal Region.—Similar to hernia containing omentum.

Hydrocele of the Cord.—Firm or fluctuating, even consistency. Attached to the cord.

Auscultation.—Hernia. Movement of gas may be audible.

Teratoma.—Negative.

Hydrocele of the Cord.—Negative.

The treatment of these tumors is complete extirpation of the cyst and its contents, under aseptic conditions; or, if the tumor has become infected, antiseptic measures and postoperative drainage of the field of operation is necessary. If the growth of the tumor has displaced any of the structures making up the supports of the inguinal canal, they should be dealt with as in operation for hernia, with a view of leaving the inguinal region well supported as a prophylactic against hernia.

Report of Author's Case.—The following case came under my care in June, 1905:

Mr. F. G. H., 32 years of age, American by birth, and a pastor by occupation, had since his fourth year noticed an enlargement occupying the right inguinal region, and secondarily invading the scrotum. He described it as having been very small at first, and reducible like an inguinal hernia may be, until recent years. He supposed it to be a " rupture." It had been diagnosed as " rupture " and as " hydrocele of the cord " by different surgeons. Its presence had not apparently affected his general health, and its growth had been slow. Of recent years, on account of its size, it had interfered with the performance of certain kinds of manual labor in which he had engaged.

One night while walking briskly along a dark street he came violently against a post, the brunt of the impact having been received over the swelling. He immediately became faint and nauseated, and felt a sudden downward motion as of something from above pushing into the scrotum on the right side. The pain subsided within a few minutes, and he presented himself at my house in a state of anxiety, having walked several blocks from the scene of the accident.

On inspection, the inguinal canal and scrotum on the right side were found to be occupied by an enlargement as great as a large cocoanut. It was rounded in outline, longer from above downward than transversely, and narrowest where it entered the external inguinal ring. The skin covering it was tense, and

spotted with petechiæ due to subcutaneous extravasation of blood sustained in the accident. It was not translucent.

On palpation, the whole mass was doughy, pitted on pressure, and exhibited an uneven, lumpy consistency, as of a soft mass occupied by more resistant bodies. Reduction was impossible, although some of the contents could be pushed upward through the external inguinal ring. The testicle was behind the enlargement.

Percussion revealed uniform flatness, and auscultation was negative.

The patient was confident that while the enlargement was being manipulated with a view of reducing a possible hernia, something slipped back out of the scrotum, but this was not at all clear to me.

On the following morning I operated. The technique was essentially that of the Ferguson operation for inguinal hernia. A semilunar skin incision was made, circumventing the right internal inguinal ring above, and in this instance continuing downward past the spine of the pubes, and over the pendant portion of the tumor. The skin and both layers of superficial fascia were reflected downward, exposing the inner and outer pillars of the external inguinal ring. The wall of the cyst resembled in appearance a thickened hernial sac.

Another incision was made through the external inguinal ring and intercolumnar fascia parallel with the aponeurotic fibres of the external oblique muscle, far beyond the internal inguinal ring. Upon retracting the aponeurosis, the inguinal canal was exposed and found to be occupied by its usual contents and the tumor mass. The cyst-wall had its highest attachment by firm adhesions to the structure forming the inner boundary of the internal inguinal ring, viz., that portion of transversalis fascia occupying the space between the internal inguinal ring and its line of attachment to the pubes behind the conjoined tendon.

The tumor was removed in its entirety and the supports of the inguinal canal, which had been considerably displaced by the presence of the cyst, were dealt with as in the Ferguson operation for inguinal hernia. In the scrotum, the large blood-clot, that had accumulated following the accident, was removed. Uneventful recovery followed the operation.

TABULATION OF REPORTED CASES.

Location of Tumor.	Size.	Contents.	Treatment.	Age of Patient.
Testicle, right.	2½ x 3 cm.	Teeth, Osseous Tissue, Hair.	Excision.	Child.
Scrotum.	Almond.	Corneal Desquamation. Fluid.	Removal. Recovery	35 yrs.
Scrotum.	Lemon.		Extirpation.	21 yrs.
Scrotum.	Hen's egg.	Sebaceous material.	Iodine injection.	30 yrs.
Testicle, right.	Fist.	Teeth. Adipose. Epithelium.	Castration.	38 yrs.
Testicle, right.	Hen's egg.	Sebaceous fluid. Cartilage. Granular material.		14 yrs.
Testicle, right.		Yellow fluid. Connective tissue.	Operation.	40 yrs.
Testicle, left.	10½ x 9 x 7 cm.	Mucilaginous fluid. Cartilage. Epithelium.	Castration.	29 yrs.
	9 x 7 x 7 cm.	Epithelial cells.		
Testicle, right.	Hen's egg.	Hair. Sebaceous material, Cartilage.	Removal.	1 yr.
Testicle, right.	Orange.	Horny material. Cartilage. Epithelium.	Castration. Recovery.	27 yrs.
Tunica Vaginalis testis.		Sebaceous and teratomatous material.	Excision. Cure.	11 yrs.
Scrotum.	Large.	Hair. Small bones.	Excision. Recovery.	20 mos.
Scrotum and inguinal region.	2 x 2½ inches.	Bone. Calcareous concretions.	Removal. Recovery	64 yrs.
Inguinal region and scrotum.	Plum.	Hair. Granular substance.		37 yrs.
Testicle, right.	26 x 27 cm.		Castration. Recovery.	33 yrs.
Testicle.	1 x ¾ inches.	Hair. Fat. Cartilage. Bone.	Excision.	8 yrs.
Testicle, left.	Orange.	Hair. Cartilage. Fat. Watery gelatinous substance.	Extirpaton	35 yrs.
			Castration.	2 y. 6 m.
Scrotum.	2½ x 5 inches.	Fœtal parts.	Excision. Recovery.	Child.
Inguino-scrotal region, l.	1 x 1½ cm.	Epithelium. Cartilage.	Volkmann's Operation, for chronic hydrocele.	16 yrs.
Scrotum.	1½ x 2½ cm.	Hair. Mucoid fatty fluid. Sweat glands.	Extirpation. Cure.	34 yrs.
Testicle, right.	Large.	Osseous material.	Removal.	8 mos.
Testicle.	14½ x 15½ x 12½ cm.	Epithelium.	Removal.	47 yrs.
Testicle, left.	2½ x 2½ inches.	Hair. Bone.	Extirpation. Recovery.	2 yrs.
Testicle and cord, right.	Goose egg.	Bone. Epithelium. Elements.	Castration.	48 yrs.
Testicle, right.		Fatty fluid. Nerve tissue.		32 yrs.
Scrotum.	Cocoanut.	Hair. Cartilage.	Castration. Recovery.	42 yrs.
Inguinal canal.	Hen's egg.	Sebaceous material. Hair.	Removal. Recovery	34 yrs.

TABULATION OF REPORTED CASES.

Location of Tumor.	Size.	Contents.	Treatment.	Age of Patient.
Scrotum, right.	Plum.	Creamy material. Hair.	Removal. Recovery	20 yrs.
Testicle, right.			Removal.	27 yrs.
Testicle, right.			Removal.	27 yrs.
Scrotum, left half.	3 x 4 cm.	Hair. Teeth. Bone.		25 yrs.
Testicle, right.	5 x 5.5 x 8 cm.	Epithelium. Cartilage.		25 yrs.
Testicle, right.	5 cm.	Hair. Sebaceous glands. Bone. Fat.	Operation.	8 yrs.
Scrotum, median line.	1 x 3 cm. 2 tumors.	Sebaceous and sweat glands. Epithelium. Oil.	Removal.	22 yrs.
Perineo-scrotal raphe, l.		Hair. Sweat glands.	Removal. Recovery	32 yrs.
Testicle, left.	Plum.	Epithelium. Muscle. Cartilage.	Castration.	27 yrs.
Testicle.		Dermoid.		
Scrotum, right.	Plum.	Bony and granular material. Muscle.	Extirpation.	18 mos.
Scrotum and inguinal canal.	Hen's egg.	?		2 yrs.
Testicle, right.	Extended to knee.	Fœtal parts.	Ligation of ring, Cure.	6 mos.
Scrotum, right.	15 x 18 cm.	Mucous and sebaceous glands. Hair. Cartilage.	Operation. Recovery.	18 yrs.
Scrotum, right.	6 x 3 inches.	Hair. Glairy fluid.	Excision. Cure.	15 yrs.
Scrotum and Hernia.	24 x 28 inches, 14 lbs.	Epithelium. Fat. Cartilage. Hair.	Removal. Cure.	60 yrs.
Testicle, right.	Orange.	Yellow gelatinous fluid. Elastic fibres.	Extirpation.	6 mos.
Perineo-scrotal raphe.	9 small tumors.	Described as dermoids.		23 yrs.
Perineo-scrotal raphe.	4 small tumors.	Described as dermoids.		29 yrs.
Testicle, left.	Turkey egg.	Hair. Sebaceous material. Teeth.	Removal.	11 yrs.
Testicle, right.	Goose egg.	Hair. Sebaceous material. Teeth.	Castration. Recovery.	12 yrs.
Testicle, right.	Fist.	Hair. Pus.	Excision.	22 yrs.
Testicle.	2 fists.	Hair. Sebaceous material. Teeth. Sudoriferous glands.	Operation.	66 yrs.
Scrotum and Testicle, l.	Hen's egg.	Epithelial glands. Fluid. Cartilage.	Excision.	16 yrs.
Testicle, right.	2 fists.	Hair. Epithelium. Sebaceous glands. Fibrous tissue.	Castration. Recovery.	18 yrs.
Testicle, left.		Putty-like material. Hair.	Removal.	
Testicle and Cord, left.	2 testes.	Detritus. Bony tissue. Fat.	Extirpation.	73 yrs.
Testicle, right.		Dermoid.		26 yrs
		Bony deposit.		

TABULATION OF REPORTED CASES.

Location of Tumor.	Size.	Contents.	Treatment.	Age of Patient.
Inguinal Canal and Scrotum.	Very large.	Parts of fœtus.	Abscess formation, Recovery.	
Similar to preceeding.	Very large.	Parts of fœtus.	Abscess formation. Recovery.	
Perineal-scrotal raphe.	Almond.	Epithelial detritus. Papillæ. Pus. Sebaceous material.	Ablation. Recovery.	29 yrs.
Inguinal Canal and Scrotum, right.	Hen's egg.	Hair and epithelium.	Operation.	31 yrs.
Testicle, left.		Epithelium. Cartilage. Fat.	Excision.	49 yrs.
Testicle, left.	Cocoanut.	Bone. Cartilage. Oil. Flesh.	Excision.	Y. Man.
Inguinal Canal.	Extensive.	Bone. Etc.	Excision.	47 yrs.
Testicle, left.	8 x 11 cm.	Epithelial pearls and muscle.	Removal.	43 yrs.
Testicle and Cord, left.	2 x natural	Epithelium. Cholestomatous material.	Castration. Cure.	28 yrs.
Testicle, left.	12 x 18 cm.	Fibrous tissue. Cartilage. Muscle.	Castration. Death in 6 months.	51 yrs.
Testicle, right.	Fist.	Sebaceous material. Hair. Cartilage. Horny fragments.	Excision. Death.	27 yrs.
Testicle, left.	22 x 23 cm.	Cartilage and Cheesy material.	Castration. Unsatisfactory.	28 yrs.
Testicle, left.	6 x 12.	Epithelium. Hair. Sweat glands.	Excision.	
Testicle, left.	3 x natural.		Excision.	39 yrs.
Testicle, left.	5 x 8 cm.	Sebaceous material. Cartilage.	Castration. Recovery.	21 yrs.
Testicle, right.	Fist.	Teeth. Osseous material. Hair.	Excision. Infection. Death.	27 yrs.
Scrotum.	Hen's egg.	Hair. Cartilage. Fat.	Castration. Recovery.	2 yrs.
Scrotum.	Multiple.	Cyst.		
Scrotum.	Very large.	Bones comparable to ribs, vertebræ, femur.		
Scrotum, right.	Very large.	Bones of inferior extremities. Muscle.	Excision.	5 mos.

TABULATION OF REGION OF DISTRIBUTION OF TUMORS.

Organ Involved.	Primary Invasion.	Secondary Invasion.	Total Times Invaded.
Testicle, right	21	1	22
Testicle, left	15	2	17
Undesignated Testicle	4	0	4
Scrotum	21	9	30
Inguinal Canal and Scrotum	13	0	13*
Tunica Vaginalis	1	0	1
Unspecified	3	0	3

Total, 78. Plus Author's Case, 79.

* Plus Author's Case, 14.

The cyst-wall was found to be made up of epithelium, sudoriferous and sebaceous glands, and to be scantily lined by fine, light brown, lanugo hair. The content was a mealy mass of epidermal detritus and gland secretion. External to the epidermal lining of the cyst was a contiguous layer of fibrous tissue.

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A METHOD OF DRAINAGE OF THE ANKLE JOINT.[1]

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SOME years ago a number of cases came under my care which varied in detail but had in common this, that they were in effect open injuries of the ankle, that the joint was much soiled by the introduction of foreign matter at the time of the original injury, that disinfection of it was practically impossible, and drainage a necessary feature of the scheme of treatment.

The results of the plans at first used were unsatisfactory to a degree. The drainage was very defective and a panarthritis usually developed, which was almost always followed by a spreading cellulitis of the leg and a general sepsis so severe that amputation through the leg had to be made, or, if this was escaped, a rigid and tender ankle only was obtained.

A more effective plan of drainage had therefore to be devised for use in subsequent cases of a similar kind.

On studying the anatomy of the ankle joint from this view point one is quickly struck by the fact that it consists not of a single compartment lined by synovial membrane but rather of two, one anterior the other posterior, separated from one another by the astragalus and the two malleoli (see Figs. 1 and 2), and in communication so far as the flow of synovia or exudate is concerned only by the narrow channels beneath the internal lateral ligament on the inside and the external lateral ligament on the outside, which channels in the presence of any swelling of the synovial membrane must be almost if not quite blocked and impermeable, but which through the continuity of

[1] Read before the New York Surgical Society, May 9, 1906.

the lining synovial membrane make extensions of inflammations from one sac to the other possible and easy. (Fig. 3.)

Furthermore the tendons in relation with the anterior and posterior ligaments compress the synovial membrane against the underlying bone and increase the difficulties to be overcome by preventing the introduction of drains of sufficient size for the purposes in view.

The plan of drainage in the earlier cases consisted essentially in the introduction of drains through the site of injury and also through counter openings made into the joint at points at which the synovial sac could be tapped most readily, and, as has been said, with most unsatisfactory results.

It seemed necessary in order to drain the joint with anything like sufficiency that space would have to be provided that would allow access to both sacs to clean them, in which to place suitable drains and through which exudate could be discharged. These conditions can best be complied with by the removal of the astragalus; for with this bone out of the way both sacs become easily accessible and there is ample room for the drains themselves and for counter openings.

Finally, the resultant state is certainly as good if not better than where, even if the leg is saved, a stiff and tender ankle is obtained.

The plan adopted, then, in several more recent cases consisted in excision of the astragalus and the drainage of the ankle through the space so created.

The method to be used in establishing this condition varies naturally with the character of the original injury.

The astragalus itself is most accessible through an incision over its head parallel to and to the outer side of the extensor tendons made with the foot strongly adducted. Through this the neck is seized by heavy forceps and drawn upon while the attached ligaments are divided and the bone freed and removed. Counter openings can now be made behind on either side of the tendo Achillis and drainage tubes placed in them. After thoroughly cleansing the joint cavity

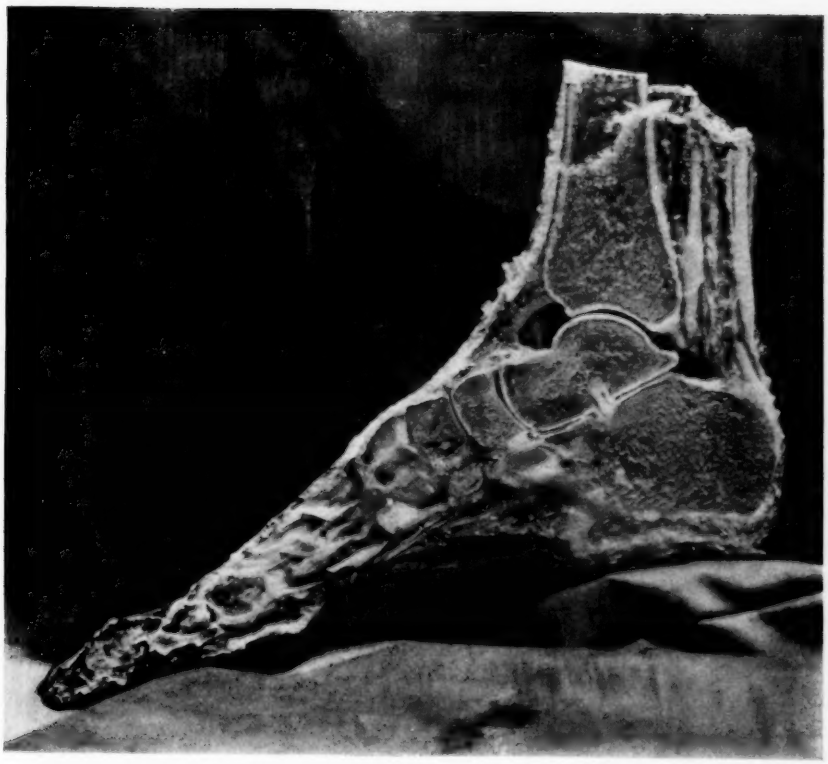

FIG. 1.—Longitudinal section showing anterior and posterior synovial sacs.

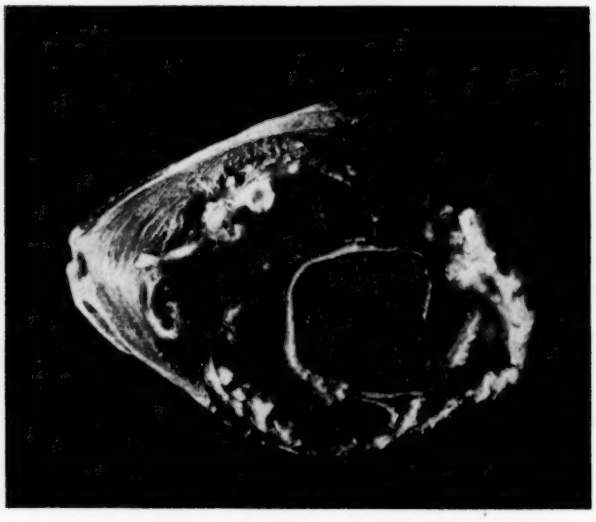

FIG. 2.—Horizontal section showing anterior and posterior sacs.

FIG. 3.—Frontal section showing, when the bones are in apposition, the slight communication between anterior and posterior sacs.

and taking care of the bone injuries the space is packed with gauze through the anterior opening and the latter kept open by the end of the gauze packing.

The foot is then brought into proper position and enveloped along with the leg in a bulky dressing and placed in a gutter splint.

The first dressing is made about the fourth or fifth day, not sooner, unless special reasons develop, and subsequent dressings at intervals of about three days

The final result shows an ankle in which there is slight motion, the foot at right angles to the leg and the distance from the knee to the under surface of the heel shortened about ⅜ to ½ inch.

Since adopting this method I have not seen a cellulitis of the leg develop and I have not been compelled to amputate in a single instance.

Although my experience has been confined to traumatic cases and among these to serve compound Pott's fractures, compound fractures and displacements of the astragalus and unclassifiable crushes of the ankle, I am inclined to believe that the same method would be of great service in certain suppurations of the ankle where thorough drainage is desirable.

As illustrations the following outlines of two typical cases may be of interest:

CASE I.—Female, aged twenty-two. Admitted to hospital after having been run over by a street car. On examination there was a traumatic amputation of the right leg at the knee for which a Carden's amputation of the thigh was done.

At the left ankle there was a severe Pott's fracture with a good deal of contusion of the soft parts about the external malleolus, comminution of the lower end of the tibia and compounded by a large wound over the inner malleolus.

For this the astragalus was removed, the joint thoroughly washed out and the space packed with gauze from in front and also drained by a tube emerging behind between the external malleolus and the tendo Achillis.

There was much sloughing of the tissues of the outer ankle, including the peroneal tendons, but no cellulitis at all. The wounds gradually closed and the ankle ankylosed in good position.

She is now free from pain, walks with a cane and has " slight motion " at the ankle.

CASE II.—Male, aged twenty-three. Admitted to hospital after elevator accident. On examination there was a fracture and dislocation of the right astragalus compounded through a lacerated wound over the head of the bone.

An attempt was made to save the joint but an arthritis soon began which made it necessary to remove the astragalus through the original wound. The space was thoroughly washed out and packed with gauze from in front and further drained by tube through counter opening behind.

Convalescence was rapid and without incident.

Some weeks later the patient was walking easily upon the extremity, the foot was in good position and there was slight motion at the ankle.

SARCOMA AND MYOMA OF THE STOMACH.[1]

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SARCOMA of the stomach is of such rare occurrence that it has received little serious consideration from clinicians and but passing notice from pathologists. The increasing frequency with which such lesions are being recorded in medical literature may indicate that many similar tumors have hitherto escaped recognition through a natural tendency to regard all gastric neoplasms as carcinomatous, or it may be merely the result of the growing interest in such affections due to the more recent and wider spread tendency towards their radical treatment.

A myoma is here included not on account of its even greater rarity than sarcoma but because clinically it may simulate exactly a fibrosarcoma and pathologically it is capable of sarcomatous degeneration.

The following three cases which occurred within nine months in Dr. Ochsner's clinic will illustrate the early development of a myoma as well as the two main clinico-pathological groups into which primary gastric sarcoma may be divided, the one clinically indistinguishable from carcinoma, the other relatively benign and at times capable of preoperative recognition.

CASE I.—Mr. C. C. (16518), aged 73. The family and past history were unimportant. The present illness began ten years previously with distress in the epigastrium and right hypochondrium, usually associated with eating, was fairly constant with occasional slight exacerbations. Only within the last few months had there been attacks of colic. These had not been more than moderately severe and quite characteristically of gall-bladder

[1]Read before the Chicago Surgical Society, June 15, 1906.

origin and were followed by temporary though slight jaundice. Neither hæmatemesis nor melæna had occurred.

Physical examination aside from a rather marked anæmia and emaciation revealed nothing of importance beyond a decided tenderness in the mid-epigastrium and over the region of the gall-bladder. The patient was sallow but not jaundiced. The gastric symptoms had been so much more intense than usually seen with cholelithiasis that, taken together with the patient's condition and age, a carcinoma or ulcer of the stomach was suspected in addition to the gall-stones, in spite of the absence of dilatation, palpable tumor and signs of obstruction. The physical and mental conditions were such that it was deemed unwise even to make a blood-count.

Operation by Dr. Ochsner June 29, 1905.—The abdomen was opened by a high right-rectus incision. As soon as it was certain that there was no danger of spreading infection from the biliary tract the stomach was examined and at first thought to be normal though a nodule, at first supposed to be enlarged retro-peritoneal gland, was palpable upon the spine behind it. The mobility of this mass suggested its inspection through a rent made in the greater omentum. This was readily accomplished and a walnut-sized slightly nodular pedunculated tumor was found growing from the everted posterior wall of the stomach near the greater curvature. Gentle traction upon the tumor pulled out a cone of stomach-wall which was clamped transversely. A purse-string silk suture was placed about the base of the cone proximal to the clamp, the distal apical portion containing the tumor was removed and the stump then inverted precisely as in an appendectomy with a continuous Cushing stitch reinforcing the purse-string.

After breaking up adhesions of the omentum, duodenum, and hepatic flexure of the colon to the gall-bladder, nine moderately large stones were removed from it and the cystic duct. The common and hepatic ducts were free. Cholecystotomy completed the operation.

The patient made a slow but complete recovery; the biliary fistula closed spontaneously. His general health steadily improved and he is now actively engaged in literary and clerical work, taking care of house and garden by way of recreation.

In a letter written May 18, 1906, nearly eleven months after operation, he says: "Barring the customary infirmities of age, I do not see but I am as well as I ever was."

Pathological Examination.—Gross: The specimen of a hard elastic nodule (3 x 2 x 1½ cm.), surface round, slightly irregular, and covered by normal looking serosa except at one pole where it is attached to a circular cuff of the entire gastric wall (1 x 1¼ cm.).

On section the tumor was made up of interlacing bundles of fibrous-looking tissue, one of which about 3 mm. wide extends around superficially beneath the serous coat but becomes indistinct at the gastric attachment.

The tumor apparently originated to the outer side of the submucosa which together with the mucosa is intact and normal in appearance.

Microscopic.—The mucosa and submucosa were in no way found to be abnormal. The tumor was made up of masses of large spindle-cells with a tendency to arrange themselves into bundles. There was no great variation in the size of the cells, the nuclei were large, centrally placed, without mitoses, and showing similar straining reactions.

VanGiesson's stain confirmed the diagnosis of the myomatous nature of this tissue. Fibrous tissue was present in small amounts, the blood-vessels were few and small. There was not complete encapsulation. At its inner growing aspect the tumor, which seemed to have sprung from the outer muscular coat, was sharply differentiated from the normal muscularis by the greater size and pallor of its cells. Though the growing edge was irregular there was no evidence of any distinct infiltrating tendency. Diagnosis: Myoma.

About forty cases of gastric myomas have been described since the first one recorded by Morgagni in 1762.

They occur more commonly in middle-aged men and grow from any of the muscular coats but are usually found near the greater curvature at the cardiac end of the stomach. Cases have been reported where the pylorus or the duodenum was involved. These tumors are usually single and commonly remain small pea-sized nodules within the thickness of the

stomach-wall but have been described as large as a man's head.

As a rule the growth is slow and the tumor remains symptomless unless ulceration or obstruction is caused or in case of the larger examples where mechanical interference is produced. The submucous variety is supposedly prone to become pedunculated and undergo cystic degeneration, the subserous to be more subject to sarcomatous degeneration.

CASE II.—Mrs. O. R. (14990), aged 37. The family and past history were unimportant. The present trouble began eight months prior to her admission, with a sudden attack of epigastric pain, radiating to the sternum and into the back, followed by a "severe vomiting spell." Shortly after this she noticed a tumor in the left epigastrium, freely movable and at times palpable to the right of the median line. Gastric distress in increasing constancy and severity ensued together with intermittent attacks of pain and vomiting, the last one of which occurred three days before admission to the hospital.

There had been no hæmatemesis nor melæna. Emaciation had been gradual, but continuous and was advanced. At the physical examination a round, hard movable tumor, the size of a fist, was present beneath the left costal margin in the epigastrium. It was not tender and was continuous with the stomach tympany. The examination otherwise aside from a noticeable anæmia was practically negative. The urine was normal, the acid gastric contents after a test meal contained no free hydrochloric acid and no organic acids. No Oppler-Boas bacilli were present. The blood-count showed erythrocytes 4,800,000; leucocytes, 8,500; hæmoglobin, 85 per cent.

Operation by Dr. Ochsner, Sept. 9, 1904.—The stomach was exposed through high right-rectus incision. A growth was found near the pylorus involving the greater curvature and posterior wall of the stomach but had apparently not extended beyond the immediately adjacent omental lymph-glands.

An incomplete gastrectomy was done, including the pylorus and the fundus beyond the Cuneo-Mayo line. The adjacent portion of the corresponding omentum was also removed. The cone of the stomach remaining at the cardiac end had such a narrow base

that it was possible to make a direct end to lateral implantation into a suitable loop of jejunum brought up anterior to the transverse colon and taken just enough distal to the duodenum to prevent traction upon the anastomosis, which was effected with two rows of continuous silk sutures. Owing to accidental infection, drainage was used.

The patient recovered fairly well from the operation and improved steadily for two weeks, when in spite of a fairly good appetite and freedom from distress she gradually lost strength and died on the twenty-seventh day.

A limited post-mortem examination of the abdomen was permitted. A few fine adhesions marked the drain tract; the anastomosis was perfect, the silk having been covered by the serosa, which was apparently continuous from the stomach on to the intestine. As far as could be determined the abdominal cavity was otherwise normal.

Pathological Examination.—Gross: The tissues removed at operation showed that the main involvement was along the posterior aspect of the greater curvature. This consisted of a mass 7½ x 10½ x 5½ cm. in size which protruded 3 cm. into the lumen of the stomach. It was situated 3 cm. from the pylorus, which was not directly involved but had probably been obstructed to some extent by the intra-gastric projection of the tumor. Two smaller nodules 2 x 2 x ½ cm. and 4 x 4 x ¾ cm. were present on the posterior wall near the large growth and to its proximal side.

The mucosa away from these tumors was fairly normal in appearance, extending well up on the sides of the growths but probably not intact over their convex surfaces, though any ulceration was slight and there was no tendency to any fungous growth. Several enlarged glands were present in the attached omentum.

On section the tumors presented a bulging, grayish, semi-translucent, homogeneous surface. The margins of the mucosa were sharp and there was no tendency to atypical epithelial downgrowth. Where the muscularis was being invaded the margins of the tumor were usually well-defined and rounded, with little macroscopic evidence of infiltration. The enlarged lymph-glands had a similar appearance, so that metastatic involvement seemed probable.

Apparently the growth began on the inner side of the submucosa and only penetrated this layer when the tumor had attained sufficient size to offer a greater counter resistance. In the most advanced portions of the large mass the growth had reached the serosa; in the less advanced it had remained distinctly within the level of the submucosa. Where the tumor had reached the serosa, whitish miliary nodules were scattered upon the surface.

Microscopically the large tumor was composed of dense, irregularly-placed masses of large round or polyhedral cells, varying from three to ten times the size of an erythrocyte. The nuclei were large vesicular, varying in size with that of the cell, and were centrally placed in a relatively small amount of pale granular cytoplasm. Few mitotic figures were present, giant forms with three to five nuclei were frequent, and metachromatophilia was marked. Numerous small round cells, very many eosinophiles and a few polymorphonuclear leucocytes occurred. The delicate stroma was slight in amount and the relatively few blood-vessels were well preserved. No thrombi of tumor cells were present, though suspicious individual intravascular forms were not uncommon.

Sections from the smaller nodules had a similar appearance, the individual cells were more alike in size and straining reactions, mitotic figures more frequent, but the giant forms and the eosinophiles were distinctly less numerous. There was relatively more stroma and fewer blood-vessels.

The mucosa away from the tumor was not strikingly abnormal, the epithelial cells were pale and granular and many chalice forms were present. No parietal cells were seen. Nearer the tumor mucosa cells with very marked eosinophilic granulations were numerous. The villous stroma was largely composed of plasma-like cells and eosinophiles. Pressure atrophy had caused a disappearance of the mucosa structures and where the growth had extended to the gastric lumen there was a slight fibrino-cellular exudate resting on a narrow more or less distinct connective-tissue base. The advancing edge of the tumor was clearly marked, the compact mass of large pale cells was sharply differentiated from the more normal structures, and in places there was a definite boundary zone between the two made up

of small round cells and many eosinophiles. There were evidences of recent remote hæmorrhages into the mucosa and submucosa.

The submucosa was the most resistant of all the layers to the destructive action of the growth, and once penetrated, persisted longer within the tumor tissue than any other normal structure. It was apparently not penetrated until pushed outward by the tumor and consequently diminished in thickness. In the smaller masses (it was evident that the growth began to the inner side of the submucosa, possibly to the lumen side of the muscularis mucosæ. Where the muscularis had not been involved by the tumor it was normal, perhaps slightly hypertrophied. The serosa was for the most part intact; where the growth had extended up to it, there were occasional perforations with a localized exudate composed of tumor cells, erythrocytes, leucocytes, and fibrin.

Sections from the enlarged lymph-glands in the omentum showed only the chronic inflammatory changes so common with gastric ulcer. No metastases were encountered. Diagnosis: Large, round-cell sarcoma.

Case III.—Mr. C. L. S. (15367), aged 44. Family history unimportant. He had always been well up to the present illness, which began ten months previously, but was an habitual user of stimulants. Immediately following alcoholic excesses, he was suddenly seized with nausea and epigastric pain followed by hæmatemesis so profuse as to cause syncope. Recovery from this attack was protracted but apparently complete and there had been but one subsequent and much less profuse vomiting of blood. Melæna was noticed at irregular intervals up to the time of admission. Four months after the onset he first noticed a tumor beneath the left costal margin. This had not increased materially in size and except from purely mechanical action had been productive of no untoward subjective symptoms. The general health was excellent and he had remarked no loss in weight nor strength.

Physical examination revealed no advanced cardio-vascular change. The liver was normal in size and there was no evidence of obstruction to the portal circulation. A considerable degree of anæmia without icterus was noticed. In the upper left quadrant of the abdomen was a round solid tumor, about the size

of a child's head, not tender, freely movable and with no palpable notches nor nodules. It descended with inspiration and on standing sank beneath the level of the umbilicus. When lying on his right side, the tumor extended to that side of the median line; when on his left side, it fell back beneath the costal margin. The mass was flat on percussion and its relationship to the stomach tympany was not established. The blood-count revealed an unexpectedly severe anæmia, leucocytes 13,000, erythrocytes 4,000,000, hæmoglobin 43 per cent. There was no abnormality found in the differential count and no adventitious elements were encountered. The urine was normal. Through an error, the examination of a test meal was omitted.

Operation by Dr. Ochsner, Nov. 23, 1904.—The abdomen was opened by a left rectus incision exposing immediately the large smooth-walled semifluctuant tumor which arose by a small pedicle from the posterior wall of the fundus of the stomach, near the greater curvature. The aspect of the intragastric portion of the tumor was dome-like and encroached very slightly upon the ventricular cavity. The surrounding stomach-walls were healthy and the viscus was but little if any dilated.

The growth had become adherent to the posterior parietes and to the omentum, and as soon as these adhesions were freed the excision of its gastric attachment was rapidly effected. An incision was made into the stomach 3 cm. from the pedicle and the corresponding margin of the proximal wall immediately clamped; thus was bleeding avoided, and by lifting gently on the forceps the escape of gastric contents was prevented. Consecutive similar steps removed the tumor with surrounding cuff of normal stomach. The resulting gastric wound was closed linearly by two layers of continuous sutures; the first, of catgut, embraced all the layers; the second, of silk, excluded the mucosa. No drainage was employed.

The patient had a rapid and uneventful convalescence and left the hospital three weeks after operation in splendid condition. At an examination made at the hospital, April 10, 1905, four and one-half months after operation, the patient was found to be in almost ideal condition. He had gained in weight and strength, and except for one attack of gastric distress, following a

dietary indiscretion, had been in perfect health. There had been neither vomiting nor melæna. The abdomen was free from tenderness, the scar pale, and the rectus muscle functioned naturally. The stomach was apparently normal in size and position. No free intraperitoneal fluid could be recognized. The patient stated that he had never felt so well at any time. Blood, erythrocytes, 5,280,000; leucocytes, 12,000; hæmoglobin 88 per cent. A test meal, consisting of 60 grams of crackers and 400 c.c. of weak tea, was given after a stomach washing. One hour later the gastric contents were removed and 100 c.c. obtained. Free hydrochloric acid was present in (60) excess of the combined (40). There was a faint trace of lactic acid. Microscopically no blood nor Oppler-Boas bacilli were found. The patient was again examined May 26, '06, 17 months after operation and found to be in excellent general condition, without evidence of any recurrence.

Pathological Examination.—Gross: The tumor was irregularly spheroidal in shape, 16½ x 12 x 8 cm. in size. Upon its upper surface there was a convex area of gastric mucosa 7 x 9 cm. connected with a mass by a constriction representing the gastric muscularis. In the middle of this mucous membrane was an ulcer one-half cm. in diameter and three-quarter cm. deep; the base was firm and evidently formed by the growth itself. Surrounding this ulcer concentrically was the pedicle 5.5 x 4.5 cm., composed of solid tumor tissue. External to this was a cuff of normal stomach-wall. The gastric serosa was continuous upon and completely covered the tumor, except where there had been adhesions or where destroyed by traumatism. The mass was deep bluish in color and the large superficial vessels were considerably distended. The general consistency was subfluctuant and on the anterior surface were superficial cysts closely related to each other, the largest, 3 x 3 x 4 cm.

On section the tumor was found to be made up of soft, gelatinous sago-like tissue, with irregularly-disposed interstitial hæmorrhages. There was both central and subcapsular cystic degeneration, in which a myxomatous metamorphosis was evidently an intermediate step. The resulting irregular cystic cavities were trabeculated and smooth-walled. A definite fibrous tissue capsule extended exerywhere beneath the serosa, and was seemingly complete.

The section through the intragastric portion indicated that the tumor had originated externally to the submucous layer, as that membrane could be readily traced up over the sides of the convex portion, and with the mucosa appeared up to the margin of the ulcer. Here the submucosa ended abruptly and the edges of the mucosa were infolded and thickened. The muscular coats had been almost completely destroyed over an area corresponding to the gastric attachments of the tumor and were distinctly hypertrophic at their marginal termination.

Microscopical.—The tumor was made up of masses of cells and stroma which varied in their relative proportions in different areas. There was also great variation in the maturity of the cellular elements. In some places more normal fibrous tissue was reproduced; in others, the cells were largely of the epithelioid type, though never without coëxisting evidence of their fibroblastic nature. The few blood-vessels were well preserved, though recent and remote interstitial hæmorrhages had occurred. In certain places large connective-tissue trabeculæ were common. A definite, dense, fibrous capsule was present beneath the normal-looking serosa. Except at the base of the ulcer the submucosa was intact and as a rule a small proportion of the inner muscular coat remained attached to it. The mucosa apart from the ulcer was practically normal, parietal cells were well-defined and numerous. At the edges of the ulcer the mucosa dipped down and around the margins of the submucosa. Here the plasma cells were much more numerous and there was a less though still distinct increase in the number of eosinophiles. Beneath the base of the ulcer a tumor nodule had grown between the inner muscular coat and the submucosa. To the pressure and consequent anæmia produced by this nodule, the destruction of the submucosa was attributed, and the ulceration of the mucosa was an indirect result. The base of the ulcer extended to remains of the inner muscular layer and the tumor-tissue. It was lined by a limited superficial fibrino-cellular exudate, which rested upon a thin layer of connective tissue. Diagnosis: Spindle-celled sarcoma.

CASES IV and V.—*Sarcoma of the Stomach.*

These two patients, aged 41 and 30 respectively, complained of pain in the right upper half of the abdomen, with distress

after eating, and occasionally vomiting. The family history in both instances was unimportant. The personal history was negative. The first patient's illness began about eight years ago, with an attack of pain lasting about six weeks. The attacks have recurred since that time about twice a year, each attack lasting about three weeks. They were of sufficient severity to confine the patient to bed. In the intervals he felt perfectly well. Medical treatment proving futile, operation was advised, and the stomach was removed. On microscopic examination, the tumor was found to be a spindle-cell sarcoma.

The second patient became ill about two years ago. One month after the onset of his illness an exploratory laparotomy was performed, ostensibly to relieve a loose right kidney. Nothing was found, however, and after the operation the attacks of pain recurred with equal severity. On palpation, a hard, irregular mass was found in the right side of the abdomen, extending from two inches above Poupart's ligament to about the level of the umbilicus. The tumor was removed.

The following summary of the more recent literature on gastric sarcoma is substituted for a discussion limited to these cases. No attempt has been made to preserve individual references, and a list of those articles from which the data has been obtained is appended. Even less than the usual scant reliance should be placed in the statistical figures, as they varied greatly in different articles dealing mainly with identical cases, and were largely indices of the personal equation of the writers.

Frequency.—It should be recognized that the incorrect diagnosis of carcinoma has been made not only clinically but pathologically, so that any statistics must represent the lower rather than the higher limits of variation. In comparable series embracing about 800 cases of gastric neoplasm, sarcoma was demonstrated in a little less than 2 per cent. W. S. Fenwick assumes that were all cases recognized, sarcoma would be found to comprise 5–8 per cent. of the malignant stomach tumors. This is perhaps partially substantiated by the fact that where Schiessinger, in 1897, was able to collect but thirty-five cases since the first one reported by Sibley in 1816, there are double that number available at the present time.

Age and Sex.—The sexes are about equally affected. The time of onset varies from 3.5 to 78 years; mean age, 34. The average for lymphosarcoma, which is most common from 20 to 35, is 29, and for the spindle-celled, is 51. Twice as many cases begin in the fifth as in any other decade. Primary sarcoma is more common in the young than is carcinoma.

Etiology.—No exciting causal factor is established. Pre-existing chronic gastritis is common, and one case is deemed to have followed a gunshot wound. No suggestion is made that the growth was associated with gastric ulcer. Unlike carcinoma, there is no predilection for areas of constant irritation, so that sarcoma is far less frequent at the orifices.

Pathology.—The stomach is involved in 33 per cent. of the sarcomata in the gastro-intestinal canal. The disease may be primary, or more rarely metastatic, except the lymphosarcoma, which alone exceed the carcinomata in the frequency of secondary invasion. Two types are the most frequent. The round-celled, including the lymphosarcoma, and the spindle-celled, including the myo- and fibrosarcoma. Myxo-, melano- (secondary), angio- and alveolar forms have been described. The growths have three main types: (1) infiltrating; (2) nodular and extending into the stomach; (3) nodular and extending into the peritoneal cavity, though transitional forms occur.

The following practical classification, slightly modified from Alessandri's, is sufficiently complete to serve as a working basis:

Infiltrating tumors.—Lymphosarcoma (great majority); round-cell sarcoma (large majority).

Circumscribed tumors.—Round-cells (few), lympho (rare, usually secondary). All spindle-cell forms, usually pedunculated.

Lymphosarcoma (15–35 per cent).—They originate as a rule on the inner side of the submucosa, but may begin even in the subserosa. A diffuse nodular thickening of the gastric walls is generally produced and the consequent destruction of, or interference with, the muscularis causes motor disturbances.

often dilatation, rarely contraction of the stomach. Hour-glass deformity has been described. Extension to the duodenum and œsophagus is not infrequent. When the pyloric portion of the stomach is thus involved, insufficiency of, rather than obstruction to, that outlet is produced. These cases show remarkably little tendency to ulceration.

Circumscribed lymphosarcomata are exceedingly rare and have been regarded as metastatic. They commonly arise beneath the mucosa as one or more nodules which protrude into the stomach but notably free from superficial ulceration.

Round-cell Sarcoma (28–45 per cent.).—This class is similar to the lymphosarcoma in pathological behavior, particularly the diffuse forms, so that differentiation is usually difficult and frequently impossible. The circumscribed variety occur in a few (6 per cent. of these tumors, and usually begin near the pylorus and project into the stomach cavity. Ulceration is, as a rule, late, and fungous growths rare.

Spindle-cell (including fibro- and the still less common myo-) *sarcoma* (32–36 per cent.).—The point of origin is outward from the submucosa, and usually located on the posterior wall near the greater curvature. The growth protrudes into the peritoneal cavity or between the layers of the omentum, the lesser omentum, or the gastrocolic ligament. These tumors may grow to enormous size. A myosarcoma and a fibrosarcoma, each weighing 12 pounds, are recorded. The mechanical action of such growths may produce gastroptosis, gastrectasia, and interfere with the normal functions of other viscera.

Location.—In this regard the variation from carcinoma is marked. The cardiac end is more or less involved in 6 per cent., the fundus in 58 per cent. and the pylorus in 36 per cent. (carcinoma 60 per cent.) with but 9 per cent. of these producing pyloric obstruction. About one-third are more or less diffuse. The greater curvature is more often involved than the lesser, the posterior wall about ten times as frequently as the anterior. The point of origin of the round-cell type has been frequently described as in the sub-

mucosa. The inner muscular layer has been designated as the boundary zone between the points of origin of the two main groups.

Retrograde Changes.—Owing to the large size attained by these tumors, degenerative changes are frequent. Hyaline, myxomatous, cystic and calcareous types have been described. The Fenwicks state that perforation of the stomach occurs in 10 per cent. of the round-cell and lymphosarcoma cases. Interstitial abscess not connected with the gastric lumen may rupture into the peritoneal cavity and cause a fatal peritonitis. It is remarkable how constantly it has been noted that there is so slight a tendency to ulceration and when this does occur it is superficial and as a rule not productive of serious results.

Adhesions.—The occurrence of adhesions to adjacent structures is very infrequent except in the cases of large extrinsic tumors. Even these are usually not firm consequently the motility of the mass is little restricted by them. Adhesions to and rupture into the colon with the production of fecal vomiting have been described.

Metastasis.—As in carcinoma, these tumors are prone to spread through the lymphatics. Remote secondary growths occur in various places somewhat similarly to cancer. About 70 per cent. of the round-cell and lymphosarcoma cases show metastases; the nearby glands are always enlarged and in 50 per cent. contain secondary growths. The nearest glands may be skipped and a more remote group involved. The kidney, liver, omentum, pancreas, ovaries, skin, lungs, pleura, intestines, œsophagus and mediastinal glands are involved in about this order of frequency. The spindle-cell forms less often have metastases, perhaps less than 50 per cent. As in the round-cell types, the perigastric glands are most commonly but less often (37 per cent.) involved. Remote growths occur in the same organs, but with correspondingly less frequency than in the other class of sarcomata.

In general it may be stated that metastases occur later and grow more slowly than in the carcinomata.

Clinical History.—It is repeatedly stated that there is no

distinction from the usual course of carcinoma. In the round-cell and lympho varieties this is true with the exception that there is no preëxisting ulcer history which is so common in carcinoma cases, though long-standing chronic indigestion is frequent. The onset is as a rule insidious, may even be symptomless. The nature and severity of the gastric distress vary with the location and form of the involvement of the stomach (infrequent obstructions, motor insufficiency, etc.). Pain is the most common symptom (76 per cent.) and may be associated with ulceration. Hæmatemesis, melæna, occur as in carcinoma; vomiting is much less common. A slowly-growing tumor is palpable in 30–40 per cent. of these cases, and is prone to appear early. Anæmia is very constant, appears early, progresses gradually, and frequently becomes extreme. The chemistry of the gastric contents is the same as in carcinoma and there is said to be no digestive leucocytosis. The recurrence of enlargement of the spleen and lingual follicles, sarcomatosis of the lymph-glands and skin, and the presence of albuminuria (which is stated to result from renal metastasis in one-sixth of the cases) have been described among the characteristic symptoms but are too uncommon or occur too late to be of any practical therapeutic value.

The conditions in the spindle-cell variety, though mainly similar to those just described, have in addition certain features that are most suggestive.

Hæmatemesis is present in 50 per cent. of these cases and may mark the onset. A palpable tumor is practically constant, freely movable and always in relation with the stomach tympany and usually causing little more than mechanical embarrassment. Anorexia and emaciation and any chronic gastric distress may be absent.

Diagnosis—It is conceivable that under certain conditions the diagnosis of the round-cell varieties might be justified, but practically it is never established without the microscopical examination of tissue recovered from the vomitus or stomach washings. Even at operation the recognition is dif-

ficult as the medullary, scirrhus and colloid types of carcinoma might give similar external appearances.

On the other hand, the spindle-cell forms should be less commonly mistaken when the clinico-pathological conditions are understood, though the differentiation from tumors of the spleen and kidney, cysts of the pancreas, ovary, and kidney, and movable kidney, has been proven by experience to be difficult.

However, the exact diagnosis is far less consequential to the patient than the prompt recognition of a condition demanding efficient aggressive surgical treatment, and this is possible in the great majority of the cases.

Prognosis.—Without surgical intervention, first practiced by Billroth in 1888, the outlook for ultimate recovery is invariably hopeless. The average duration without operation is 15–18 months for the round-cell and 24–32 months for the spindle-cell forms, both distinctly longer than carcinoma.

Theoretically the operative treatment promises better results than in carcinoma, as the tumor is of slower growth, far less apt to become adherent, metastases occur later and are prone to slower growth. Practically this is well borne out in operative results. Corner and Bairbank have collected fifteen cases in which excision was practiced with 20 per cent. immediate mortality; four cases (27 per cent.) were well four, five, twelve and twenty-four months after operation. The average duration previous to the operation has been ten months. Cantwell's cases of excision of a twelve pound spindle-cell tumor with great relief to the patient for eight months upholds the belief that even the advanced cases should be explored and treated radically if conditions are not contraindicative.

Conclusions.—Sarcoma of the stomach, though an uncommon affection, is less rare than has been supposed. The diagnosis of the round-cell varieties is practically impossible, though its existence under certain conditions might be suspected. Those of the spindle-cell type should be frequently recognized and often suspected. In either case the early

recognition of a purely surgical condition is in the majority of instances easy. Since prompt radical treatment offers not alone the best but also the only hope of permanent relief, without a forbidding immediate mortality (which should now not exceed 10 per cent.), procrastination here, as in all cases of suspected malignant disease, is in keeping neither with science nor humanity.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, May 9, 1906.

The President, Dr. George Woolsey, in the Chair.

PERINEAL PROSTATECTOMY.

Dr. Charles H. Peck presented a man, sixty-three years of age, who was admitted to Roosevelt Hospital, in the service of Dr. Brewer, April 11, 1906, giving the following history: He had an attack of gonorrhœa at nineteen years of age; no history of syphilis. Was a heavy beer drinker for many years, but drinks nothing now. In 1877 he first noticed an obstruction to ejaculation during coitus, with momentary pain in head of penis, followed by a dull ache referred to perineum. This condition gradually increased in severity for a year or two, when difficulty in urination was first noticed; the stream was started with difficulty, was small, and caused a burning pain along entire urethra; after drinking large quantities of beer these symptoms became greatly aggravated; the burning sensation would become intense, and there would be bearing down pains in the groins, the pain radiating down into the testicles. For many years the patient had these symptoms, varying in intensity according to his general health, and also according to the amount of beer he drank. About three years ago he began to get up at night to urinate; at first, only once, later two or three times. About six years ago he had an attack of retention of urine, which lasted only a short time, and

was relieved by morphine, without catheterization. Last December, after drinking some beer, another attack of retention occurred, and for two days the urine had to be drawn by a physician, after which time voluntary urination again became possible. Since that time he has had no absolute retention, but he has had to get up more frequently at night; five or six times, and pain on urination has increased, radiating from the groin down into the testicles. His general health is good, and he has no other symptoms.

Examination.—Rectal examination shows a high implantation of the prostate, with both lateral and vertical enlargement. Cystoscopic examination shows intravesicular enlargements of the middle lobe; muscular walls in good condition; bladder capacity good; no residual urine. Urine showed a trace of albumen; no casts.

Operation April 16, 1906. Ether anæsthesia. Lithotomy position, with hips elevated. Median perineal incision; urethra opened on a grooved guide; prostatic urethra dilated with dressing forceps and Young's prostatic retractor inserted into the bladder. Rectum separated from prostate by blunt dissection with finger as high as superior border, with finger of left hand in rectum as a guide. An incision made with scalpel through capsule of left lateral lobe; ungloved finger inserted beneath capsule, and a large globular mass carefully enucleated and removed without injuring prostatic urethra. The process was then repeated through a separate incision over right lateral lobe, and a similar mass, somewhat smaller, was enucleated, using the ungloved finger of left hand for this side, while the right hand manipulated the retractor. By tilting the retractor, a small middle lobe was then enucleated through the cavity left by removal of the right lateral lobe. Especial care was taken in enucleating the upper surfaces, adjacent to the base of the bladder, and the inner borders adjacent to prostatic urethra. The bladder-wall was not damaged, nor, as far as could be determined, was the prostatic urethra injured to any extent.

The time from incision to the complete enucleation of all lobes was fourteen minutes; six minutes more were occupied in passing a No. 33 F. sound through the urethra into the bladder, searching for a possible stone through the perineal wound, irri-

gating the bladder, fastening the perineal drainage tube in place, and closing the wound, making a total of twenty minutes for the operation.

Hæmorrhage was very moderate; no vessels were clamped or ligated, a strip of gauze packing on either side of tube sufficing. There was no evidence of shock.

There was very little reaction, the highest temperature being 101, on the fourth day. Tube drained well; it was removed on the sixth day. A No. 29 F. sound was passed to the bladder on the eighth day, and again on the twelfth day.

The patient was allowed out of bed on the ninth day. By the tenth day, partial urinary control was established, urine passing both by urethra and perineal wound at each act, but not escaping between times. The interval between acts of urination rapidly lengthened, and on the sixteenth day he went from 7 P.M. until 5 A.M. without urinating or wetting the dressing.

On the eighteenth day, urine had ceased to come by the perineal wound, all passing by the urethra.

DR. GEORGE WOOLSEY said that while Dr. Peck's case was an example of the easy type of perineal prostatectomy some of them were very difficult. The speaker said he was struck by the paper of Dr. Young, of Baltimore, showing the frequency with which he had met with malignant conditions of the prostate. Personally, he had seen but one such case, and in that instance the malignant process was very distinct. The median perineal incision, which Dr. Peck had employed in his case, gave an excellent exposure of the prostate, and the speaker said he had resorted to it last summer, with good results, in dealing with a case of fistula between the rectum and urinary tract. One objectionable feature to an extensive perineal incision was the long period of convalescence it entailed.

DR. PECK, in reply to a question, said there was no history of residual urine in his case. In view of the size of the prostate, this was rather surprising, but it was probably explained by the fact that the greater portion of the hypertrophy was in the lateral lobes. The absence of residual urine accounted for the comparative mildness of the symptoms, in spite of their long duration. In cases of this type, Dr. Peck said, and where there was no suspicion of malignant disease, the short, median perineal incision seemed to be of peculiar advantage.

A METHOD OF DRAINAGE OF THE ANKLE JOINT.

DR. PERCY R. BOLTON read a paper with the above title (for which see page 595).

DR. WOOLSEY said it had always seemed to him that the methods commonly employed in cellulitis about the ankle joint or actually involving the joint gave very unsatisfactory results, and any improvement on those methods should be welcomed. The speaker said he had often noticed how well patients got along without the astragalus, especially after its removal for the correction of club foot. In such cases, of course, the operation was a clean one, but even when the bone was removed in cases where infection had already occurred, the result, according to Dr. Bolton, was very good.

DR. PECK said that while he had no personal experience with the method described by Dr. Bolton, he appreciated how rational it would be in dealing with certain conditions about the ankle joint. He recalled one case within the past year where an amputation was done which might possibly have been avoided had this method been resorted to. The case was a low form of osteomyelitis in the tibia, and proved so intractable that amputation was finally deemed advisable.

DR. JOHN A. HARTWELL said he could corroborate what had been said about the poor results obtained by the older methods. He recalled the case of a woman who, after an abortion, became septic, and finally the ankle joint became infected. The joint was freely opened, and the wound drained both anteriorly and posteriorly, but in spite of this the infection spread upward, and finally amputation through the middle thigh was done as a life-saving measure. The astragalus was not removed.

Dr. Hartwell said he could recall a number of other traumatic cases in which the joint had become infected, and in some of them, in spite of free drainage, amputation was finally necessary. In one case in which the leg was saved, the joint remained so indurated and painful that it was almost as bad as an amputation.

MULTIPLE SEPTIC INFARCTS OF THE RIGHT KIDNEY—NEPHRECTOMY.

DR. CHARLES H. PECK reported the case of an unmarried woman, thirty-one years old, who was seen in consultation with Dr. R. H. McConnell on April 8, 1906. She had not felt well

for about three months, complaining of headache and malaise. and during this time the urine had persistently shown the presence of albumen and casts, which had, however, diminished in amount under treatment. There had been no localized pain, elevation of temperature nor other symptoms up to Saturday, April 7, when at 9 A.M. she was suddenly taken ill with a chill, soon followed by a severe pain in the right side of the abdomen, and vomiting. When first seen by Dr. McConnell, at 2 P. M., the temperature was normal; pulse 84; there was no tenderness nor rigidity, and the pain had abated somewhat. Later in the day another chill occurred, and the following morning a third, with increased pain. At 7 P.M. on April 8, the temperature was 101, and there was marked tenderness and rigidity in the right flank. At 8 P.M. there was another chill, and at the time of the consultation, 10 P.M., the temperature was 103.6, there was marked tenderness and rigidity, and a distinct feeling of a mass in the right flank in the line of the colon at the level of the umbilicus. No tenderness could be elicited by pressure over the kidney posteriorly. A probable diagnosis of appendicitis, with a high retrocolic appendix, and localized abscess, was made, and operation advised. The following day she was admitted to the French Hospital. Another chill occurred at 4 P.M., followed by a temperature of 104. Leucocytes were 30,400, and polynuclear cells, 92 per cent.

Operation, at 8.30 P.M., about sixty hours after the onset of her acute symptoms. Chloroform and ether anæsthesia.

Appendix exposed through a high right Kammerer incision. It contained a concretion, but showed no evidence whatever of acute inflammation. It was removed, and the stump inverted in the usual way. The liver, gall-bladder, and pyloric region of the stomach appeared normal. The mass felt was easily identified as an enlarged right kidney. The abdominal wound was quickly closed and the patient turned on her side. The right kidney was exposed by an oblique incision; the surrounding fatty capsule was œdematous and somewhat adherent. The kidney was considerably enlarged, and through the capsule proper numerous small, white, elevated points could be seen. On stripping off the capsule, these proved to be minute abscesses, droplets of pus appearing on the cortex. Nephrectomy was deemed the safest procedure, in view of the acute septic symptoms and the mul-

tiple lesions, and the kidney was removed, the ureter and vessels being separately ligated with heavy chromic gut. Two cigarette drains were placed down to the pedicle, and the remainder of the wound closed by layers, with chromic gut, silkworm gut, and silk. Time of both operations fifty minutes; condition fair.

On section, the kidney showed numerous minute abscesses in the cortex, and moderate general enlargement. There was a small calculus in the pelvis, but no pus. Cultures from the abscesses showed a pure growth of the colon bacillus.

On April 11 the leucocytes were 17,240, and the polynuclear cells 89 per cent. On April 12, 12,800 and 85 per cent.; on the 16th, 8,800 and 73 per cent. The temperature and pulse dropped steadily, and since the sixth day after the operation have been practically normal.

The urine, before operation, contained a distinct trace of albumen, with granular and epithelial casts, and pus-cells. Since the operation a faint trace of albumen and a few pus-cells have persisted, but no casts. The quantity secreted by the other kidney has been from twenty-five to forty ounces daily. The abdominal wound healed *per primam*, as did the kidney incision, except for slight suppuration along the drainage tract. Patient was allowed out of bed on the twenty-first day after the operation, and left the hospital on the twenty-seventh day, practically well.

Dr. Bolton said that up to a year or so ago he believed that the condition of septic infarcts of the kidney was an indication for the removal of the organ. About that time he saw a woman at the New York Hospital who had two kidneys of this kind, and it was very interesting to watch the history of the case. She would complain of violent pain in the region of the kidney, a mass would become palpable, and the woman would become markedly septic. Then the symptoms would gradually abate, and the tumor would disappear. Exacerbations of this kind would recur at varying intervals, on one side or the other, until finally, after some months, the attacks ceased, and the patient left the hospital fairly well.

The history of that case, Dr. Bolton said, corresponded with what Dr. Robert F. Weir had told him long ago, that some of these cases of miliary abscesses recovered spontaneously, a fact which he had seen verified at autopsy.

Dr. Hartwell said the blood-counts in the case reported

by Dr. Peck were a good illustration of the point raised by Dr. C. L. Gibson in his paper on the "Value of Differential Leucocyte Count in Acute Surgical Diseases," which was read at a recent meeting of the Society, and published in the ANNALS OF SURGERY, April, 1906. In Dr. Peck's case, just prior to the operation, the leucocyte count, practically, was 30,000, with 90 per cent. of polynuclear cells, and this disproportion between the leucocytes and the polynuclears persisted dnring the patient's recovery, the latter remaining high, indicating, as Dr. Gibson had pointed out, a favorable prognosis. The case emphasized the value of the diffential blood-count as a diagnostic and prognostic aid in cases of this character.

DR. JOHN F. ERDMANN suggested that in certain of these cases, conservative treatment by incision and drainage should be given a trial before resorting to nephrectomy. Some three or four years ago he did a nephrotomy for a ruptured hilum, with multiple abscesses, and drained the kidney, but on the fifth day he removed the organ entirely. Eight months later, a large calculus was removed from the opposite kidney. That case, the speaker said, had impressed him with the importance of the greatest conservatism in renal surgery.

DR. WOOLSEY referred to the case of a man who had subacute renal symptoms associated with a palpable right kidney, the lower end of which seemed to be much enlarged, and upon operation it was found to contain numerous cortical abscesses, which were limited to the lower pole of the organ. As the upper section of the kidney was apparently normal, he removed the lower third, and after suturing, allowed the rest of the organ to remain. The patient made an excellent recovery. The case was one of staphylococcus infection.

DR. PECK, in reply to a question, said that the calculus in the case he had reported was a small one, and could not be palpated before the kidney was opened. The patient had given no previous symptoms of stone, and there were no evidences of a pyelitis. In removing the kidney in this case, Dr. Peck said, he had been influenced largely by the fact that, according to the literature on the subject, those cases that were drained did badly, and for that reason a nephrectomy was justifiable. In future, however, he would be inclined to give conservative methods a trial.

TRANSACTIONS

OF THE

CHICAGO SURGICAL SOCIETY.

Stated Meeting, May 4, 1906.

The President, Dr. D. A. K. Steele, in the chair.

THE DIAGNOSTIC VALUE OF POTASSIUM IODID IN SYPHILIS.

Dr. Edward H. Ochsner exhibited a patient to illustrate the fact that the statement commonly made in text-books that potassium iodid when given in sufficiently large doses proves or disproves the presence of syphilis is not necessarily correct. He has quite a list of syphilitic patients who had previously received very thorough treatment with potassium iodid without benefit.

The patient exhibited had been referred to him by a practitioner who had treated the patient with potassium iodid and intramuscular injections of bichlorid of mercury on the theory that the patient was syphilitic, but as the progress of the disease did not seem to be retarded in any way, he had begun to doubt his original diagnosis.

The lesion which involved the nose was so typical of tertiary syphilis that there could be practically no doubt as to the diagnosis, consequently the patient was put on fumigation treatment with calomel, and potassium iodid internally, with the result that the lesion rapidly improved and with the exception of slight persisting deformity the patient appears to be cured.

Dr. Arthur Dean Bevan asked whether the fumigation treatment of syphilis is applicable in all cases? His experience has been that in some cases one method is successful while in other cases another method of treatment achieves results. He has also seen cases of advanced syphilis which would clean up very rapidly under four or five grains of potassium iodid daily which were not affected by eighty or ninety grains a day. Then, again,

some of the tertiary forms of the disease clean up more rapidly under the mixed treatment than under either potassium iodid or mercury. He recalled one case of tertiary syphilis in which the lesions would fade away under the iodid, would be benefited somewhat by the protiodid only to reappear rapidly, and again disappear for months after a few hypodermic injections of bichlorid.

Dr. L. A. Greensfelder suggested that the proper dose of potassium iodid is the one that produces the physiologic effect, no matter what its size. Until that effect appears it is impossible to say that the patient has received a sufficient dose. The intravenous injection of a one or two per cent. solution of the bichlorid directly into a vein, giving one or two c.c. every day for fifteen or twenty days, is quite efficacious in these cases. He used that method in cases that were under the potassium iodid treatment, and also under the intramuscular injection treatment, and in which no effect was produced. After three or four intravenous injections the result was quite prompt. He said that it is essential not to use less than a one per cent. solution, and if that fails to produce any effect, a two per cent. solution should be used.

Dr. Wm. Hessert also recommended the intravenous injection method. He now has under his observation a patient who had been treated by all other known methods without result. After about half a dozen injections of three c.c of a one per cent. solution of bichlorid a very satisfactory effect became evident. The lesions on the skin and elsewhere, which had been very marked, disappeared rapidly. He believes that in protracted and obstinate cases of syphilis the intravenous method is one of the most satisfactory methods of treatment.

Dr. Ochsner agreed with Dr. Bevan that a method which fails in one case may succeed in another. He does not believe that the fumigation treatment is a specific for all cases of syphilis but in his experience every case that has resisted the potassium iodid, or even the mixed treatment, has responded to fumigation. He referred to one case that had received as large doses of potassium iodid as she would tolerate for seventeen years without being cured. She was put on the fumigation method and during the last three years there has been no new outbreak of the disease.

The patient is placed in bed, disrobed, a frame is placed over the patient and over this a rubber sheet covered with several blankets. Only the head of the patient is allowed to project. A funnel is introduced under the bed clothes at the lower end of which there is a pan containing one or two drams of calomel. Under this pan a bunsen burner is placed and the fumes of the calomel are distributed over the body of the patient. These hot-air bath fumigations age given every day or every other day, according to the tolerance of the patient.

He could not give an intravenous injection of mercury or any other drug until he had tried all the other and simpler methods of treatment. He thought that intravenous injections were given altogether too frequently just at present and that he would use them only as a last resort.

RENAL TUBERCULOSIS; NEPHRECTOMY.

Dr. William Hessert reported the case of a woman; aged thirty-five; single; father died at seventy of kidney trouble; three cousins died of tuberculosis; habits good; menstrual history normal; who during the last weeks of 1905 began to "run down," felt tired, lost weight and appetite, and there was a general feeling of malaise and exhaustion. No other specific symptoms of any kind. Went to a hospital for a "rest cure," and gained slightly, but had profuse night sweats. No pain nor chills. This condition lasted for some weeks, when she noticed that the urine looked purulent. She had no pain nor any other urinary symptoms. She was then seen by Dr. D. E. Murphy, who referred her to Dr. Hessert.

Examination revealed a large mass in the left renal region, the size of a child's head, immovable, not tender, rather firm in consistency, and not fluctuating. Urine loaded with pus. Temperature 101° to 103°.

Blood examination: White blood corpuscles, 13,200; red blood corpuscles, 4,430,000. Hemoglobin, 52 per cent. Polymorphonuclear, 79.5 per cent.; large lymphocytes, 13 per cent.; small lymphocytes, 6.9 per cent.; eosinophiles, .6 per cent.

The ureters were catheterized by Dr. L. E. Schmidt. Urine from right ureter normal. From left ureter there was with difficulty obtained a small amount of fluid for examination, which

proved to be practically pure pus, with no urinary consituents.

Indigo carmine injection into buttocks. After six minutes color was perceptible in urine from right side, while it did not appear after five hours from left catheter.

Cryoscopic examination of blood showed a freezing point of 0.58.

A diagnosis of pyonephrosis was made and the kidney removed in the usual manner by oblique lumbar incision. The kidney measures 8 inches in its largest diameter. Nothing of renal cortex was visible macroscopically. The kidney was converted into a multilocular pus sac. The pus was partly fluid, partly cheesy. At the lower pole was a cheesy area, over one inch in diameter. Microscopic examination proved the process to be of tubercular origin. There were no stones.

The patient made an uneventful recovery and has since regained her health and increased in weight.

Dr. Bayard Holmes was not sure that tuberculosis appears in a single kidney in a large proportion of cases. He has had several unfortunate experiences, and one quite fortunate one. He operated on a young man in 1896 who had trouble with his back, hæmaturia and strangury, and a diagnosis of tuberculosis of the right kidney was made. An incision was first made over the left kidney and it was examined. Two apparently tubercular foci were found. They were cut out, scraped thoroughly, packed with iodoform gauze and drained through the back. An incision was then made over the right kidney and from it five similar foci were excised, scraped, packed and drained through the back. Since that time the man has had a permanent fistula in the right side, and in the left side a fistula which closes occasionally. He has continued at his occupation, that of a barber, for ten years, and is getting along very nicely.

Dr. D. N. Eisendrath was of opinion that the specimen was typical of a tuberculosis of the kidney. He emphasized the uselessness of drainage in these cases, even in the early stages of the disease. The rational treatment in the majority of these cases is a complete and radical extirpation of the kidney. He also agreed with Dr. Holmes that a large percentage of these cases of kidney tuberculosis are bilateral and not unilateral. Many early cases undoubtedly are unilateral, but in the advanced

cases where the infection has descended to the bladder and ascended the opposite ureter, the disease is bilateral.

In all cases of septic disease of the kidney he has made it a rule not to ligate the stump of the ureter but to cauterize it thoroughly with pure carbolic acid followed by pure alcohol. The best plan, he thought, if there is extensive involvement of the ureter in tuberculosis, is to follow it down to the bladder and extirpate.

He thought that gonorrhœal urethritis and cystitis laid the foundation of a tubercular involvement. He has seen cases beginning as a gonorrhœal epididymitis and cystitis in which later tubercle bacilli appeared in the urine. After the affected kidney was removed the same germs obtained in a pure culture from that organ.

DR. L. L. MCARTHUR protested against the use of the ureteral catheter in cases presenting a very infective urine. He thought he had a case under his care which was a possible infection of a well kidney by that procedure. A very competent man examined the ureters with a ureteral catheter finding a stenosis of left ureter negative on right side. Some months afterwards, the diagnosis having become perfectly clear of pyonephrosis the left kidney was removed. The wound healed by first intention, but the urine from the remaining kidney contains pus. The kidney removed was probably tubercular. The patient had some pain on the right side, whereas when the cystoscopic examination was made some months before that kidney was found normal.

Giordano of Venice recently suggested a little procedure which seems to be a valuable one, and that is, while using the cystoscope to note the flow of pus suspected to come from one ureter or another, the assistant compresses firmly, at a given signal, the kidney suspected to be involved and if there is any purulent material in it, it often can be squeezed out, thus making it unnecessary to pass the catheter up that ureter. Both kidneys can be made to empty their pelves in that way.

CYST-ADENOMA OF JAW.

DR. L. L. MCARTHUR presented a man, forty-two years old, who eighteen months previously noticed a tumor in the lower jaw beneath the left first molar tooth. The tumor involved the alveolar process and the body of the bone. It gradually increased

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in size becoming about two inches long and one and a-fourth inches thick. A dentist removed the tooth, which gave little relief. When the tumor enlarged again, the man went to a physician, who lanced the growth. A thick, clear fluid mixed with blood poured out. This was repeated at intervals seven times with the same result. Pus was never seen. Finally the tumor increased so much in size that its removal became necessary.

On admission to the hospital the man presented a tumor of the lower jaw evidently within the bone, expanding it and giving a little crackling sensation when firmly compressed, as if the bone covering was of about the thickness of an egg-shell. An incision was made along the inferior border of the jaw; the periosteum of the bone was elevated and the thin wall of bone was readily broken down. Beneath this was a cyst filled with a thick mucoid material. The cavity in the bone was lined with a smooth mucous membrane. Within this was a pedunculated tumor. The alveolar process was removed anterior and posterior to the growth but the mandible was not resected.

The growth is one of those rare forms of odontomata classified as an adamantinoma, taking its origin from portions of the teeth buds and the character of the growth varies with the character of the primary portions of tooth structure which take part in the development of a tooth. Microscopically, on superficial examination, the specimen resembles an epithelioma, but the growth never causes any pain, nor, once well removed, recurs.

DR. THOS. L. GILMER thought that the case of tumor of the jaw reported by Dr. McArthur taught a valuable lesson. It showed that surgeons should not be too hasty in advising removal of the jaw or sections of it, especially of the mandible, because it produces a very serious deformity, one which is remedied only with difficulty. He thought the tumor shown probably had its origin in the persitent portions of the epithelial cord of the enamel organ. He referred to several cases of tumor seen by him, odontomas and cyst-like tumors, one of which contained a number of denticles or inperfectly-developed teeth.

DR. D. N. EISENDRATH referred to an article by Dr. Bloodgood in *Progressive Medicine* of December, 1905, describing a case of tumor of the jaw producing enormous enlargement, which he termed a cystadenoma, which he thought is probably

the best name for this class of tumor. These tumors are comparable to those occasionally occurring in the ovary. He thought Dr. McArthur's case particularly interesting because there was only one cyst, whereas in the other cases published there have been multiple cysts, each cavity being lined by a membrane similar to the one in Dr. McArthur's case.

HEMANGIOENDOTHELIOMA OF AXILLA.

DR. L. L. MCARTHUR demonstrated a specimen obtained from a case of apparent recurrence of a carcinoma of the breast, in the axilla. The recurrence took place about three months after the breast had been resected. The tumor was of considerable size. The X-ray proved ineffectual. Clinically the tumor presented all the characteristics of a recurrent carcinoma. On microscopic examination of the original tumor it was pronounced a sarcoma; however, the pathologists in this city pronounced it an endothelioma of the perivascular type, a hæmongion endothelioma perivasculare. The slides were presented because on superficial examination they present the characteristics of the most malignant groups, but on close study will be seen to be as described, and therefore requiring less radical interference and giving a more hopeful prognosis.

SARCOMA OF THIGH.

DR. A. J. OCHSNER reported a case of sarcoma of the thigh and exhibited the leg which had been removed that day. He made use of a method which is exceedingly simple and effective. It is a revival of a method in almost universal use fifty or sixty years ago. He read a number of reports of hip-joint amputation which were published in Virchow's Archiv about the middle of the last century, which seemed to be so uniformly favorable that he concluded to give the method a trial. It consists in ligating the femoral vessels primarily and then grasping the other vessels as the dissection is proceeded with. The hip can be amputated in a short time with the loss of almost no blood. The sciatic and the anterior crura nerves in this case were injected with cocain.

The tumor in this case evidently was the result of repeated traumatizing of the thigh incident to the patient's occupation.

Stated Meeting, June 15, 1906.

Dr. A. K. STEELE, President, in the Chair.

CERVICAL RIB.

DR. WM. HESSERT exhibited a girl aged sixteen, who had applied for treatment of a fractured clavicle. On examination a bony tubercle was found over the inner aspect of the clavicle. This tubercle was the anterior extremity of a bony process which could be followed by palpation backwards and inwards. The x-ray examination showed a cervical rib (Fig. 1.). There had been no symptoms of pressure on the nerves or artery, nor anything else that would draw attention to the malformation.

CARCINOMA OF THE THYROID GLAND.

DR. A. E. HALSTEAD reported the case of a man, aged forty-two, with a negative personal and family history, who had had an enlargement of the neck for about eleven years. During the past few years the tumor had increased in size considerably and other tumors appeared in the neck region. The dyspnœa finally became so severe that an operation was necessary. The operation was performed under local anæsthesia and all the masses were removed. Microscopic examination of the cervical lymph-glands showed an adenocarcinoma. Besides the carcinomatous growth the tumor mass itself showed nearly all the varieties of goitre, including hypertrophy, colloid degeneration, cysts, calcareous deposits and bone. The tumor surrounded the trachea and pushed it over to the left, crowded down into the thorax two inches below the sternal notch. The patient made a good recovery and is now enjoying perfect health.

DR. E. W. ANDREWS referred to a case of tubercular degeneration of the thyroid. The patient had several tubercular glands in the neck and then developed a small cold abscess in the thyroid. After pulling out shreds of thyroid tissue for several weeks, he finally enucleated the whole gland as a necrotic mass. The patient developed symptoms of myxœdema and later died suddenly.

DISLOCATION OF METATARSO-PHALANGEAL JOINT.

DR. HALSTEAD reported the case of a male patient, aged 18 years, who had his foot caught in an elevator, causing a dis-

FIG. 1.—Cervical rib.

location of the metatarso-phalangeal joint of the big toe and fracture of the second tarsal bone as well as a Pott's fracture. Several attempts were made to reduce the dislocation under anæsthesia, but all failed. Finally an open operation was done and the dislocation was reduced. It was found that it was not the short flexor but the long flexor which had become lodged between the head of the metatarsal and the base of the phalanx and was preventing reduction. As soon as the long flexor was pulled out with a blunt hook, reduction was accomplished without any difficulty whatever.

DR. E. W. ANDREWS cited a parallel case of dislocation of the thumb in which he made a small incision and by prying with a flat director he managed to slide the phalanx on to the metatarsal, where it stayed.

DR. D. A. K. STEELE reported a similar case of dislocation of the metatarso-phalangeal joint of the big toe following an elevator accident. Repeated attempts by a local physician to reduce the dislocation, even under anæsthesia, had failed. Dr. Steele, recognizing the irreducibility of the dislocation, did an open operation and found that it was the long flexor that was lying between the bones and prevented reduction. Even strong leverage failed to effect reduction until the tendon of the long flexor was withdrawn when reduction was effected very easily.

INTESTINAL OBSTRUCTION FROM MECKEL'S DIVERTICULUM.

DR. WILLIAM M. HARSHA reported the history of a woman aged thirty-seven; who during the past two years had had one or two attacks of severe cramps in bowels without serious disturbance; no history of injury or intra-abdominal inflammation. When suddenly, May 8, 1906, she was seized with severe abdominal pain, beginning at pit of stomach, soon localizing below and to the right of umbilicus. Vomiting ensued in a few hours and continued at intervals for five or six days. Obstinate constipation, enemas only bringing away small amounts of fecal matter and very little flatus. Vomiting became intestinal, but not distinctly fecal. No temperature until third day. Slight chill, followed by temperature of 101°.

Examination:—Patient well nourished; heart, lungs, and kidneys normal. Pulse 110. Temperature 99.8°. Anxious

expression. Abdomen somewhat distended and sensitive. Through vagina soft resistance found in front of pelvis, feeling eke a moderately-distended cyst, but no fluctuation could be illicited.

May 15, 1906, at the Chicago Hospital, the abdomen was opened by a median incision; considerable serum, slightly blood-stained, in peritoneum. Enormously distended, injected and œdematous intestine rolled out, which proved to be the ileum. At one point the peritoneal coat was ruptured transversely for more than one inch, which rent was sutured. Following the inflated gut down, the operator came upon a constricting band, which was clamped and cut. This band proceeded from a Meckel's diverticulum which was at its base nearly the size of the normal ileum, had a mesentery, and was not more than ten inches from the ileocæcal junction, and about three-quarters of an inch long. (Fig. I.) The distal end, or constricting band, after passing over the ileum, penetrated the mesentery of the ileum, and seemed to be joined to, or to have proceeded from, the mesentery of the diverticulum. After ligating in two places it was cut, and when the distal stump was released from the clamp it withdrew through the mesentery of the ileum and was lost to sight, leaving a hole in the mesentery.

There were no adhesions or evidences of inflammatory changes about the intestinal tract. The appendix was normal in appearance, with no adhesions. The ileum when released presented on its upper half a deep groove, almost a cut into or through the peritoneal coat; a suture or two closed this groove (Fig. 2). The gas passed into the former collapsed portion of the ileum, relieving the great distention above. The intestine seemed viable and the abdominal wound was closed without drainage; at the end of four days, however, a fistula was formed, and fecal-smelling fluid escaped for a few days, when the wound closed spontaneously and the patient went home, about the twenty-fifth day after operation.

The diverticulum was ample in size, short—less than one inch long—and had a short mesentery. The band was ligated at end of diverticulum, and was not more than two inches long to its point of penetration of the mesentery of the ileum.

Dr. A. E. Halstead has ably reviewed the *modus operandi* of obstruction from this cause, reported in the ANNALS OF

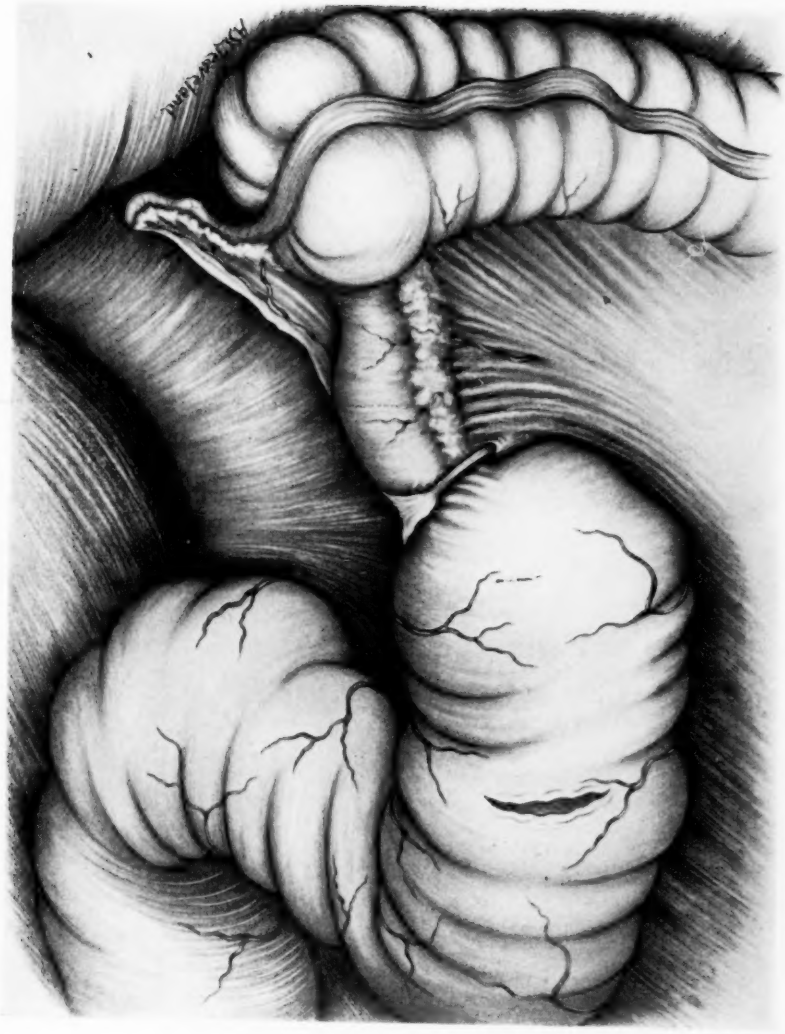

FIG. 1.

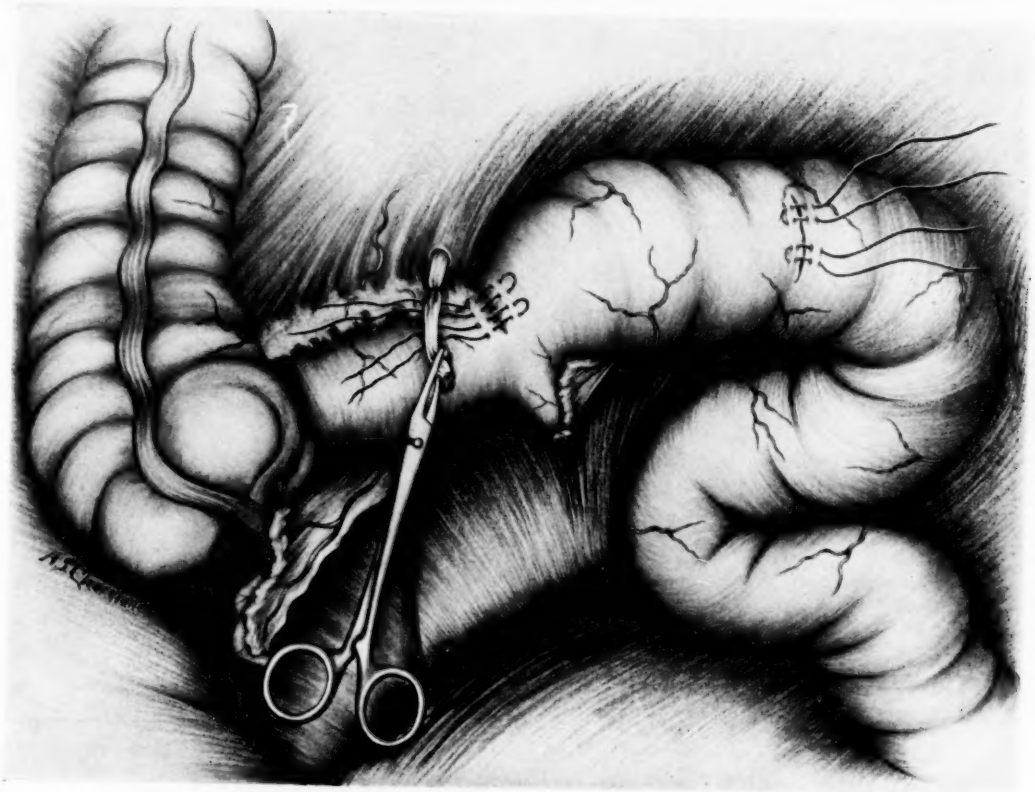

FIG. 2.

SURGERY, Vol. 35, p. 471, and in the *Journal of the American Medical Association*, Sept. 23, 1905, Dr. Miles F. Porter reviews 184 cases.

The short band crossed over the ileum from below and penetrated the mesentery of the ileum above it. The diverticulum was at right angles to the ileum and extended straight downward from the lower side of the intestine. The attachment of the distal end of the band was to some point beneath the mesentery, apparently to the root of the mesentery of the diverticulum. It is easy to see how obstruction could be caused by a sudden distention of the upper end of the ileum by either gas or fecal matter, especially when the patient was standing.

The attachment of the distal end of the band was such as to presuppose it original or primary. It could not be accounted for in the ordinary way—*i.e.*, that as the remains of the vitelline duct it had broken loose from the umbilicus and penetrated the mesentery of the ileum above to form so strong an attachment below or under it.

The most reasonable explanation is that in this case the band at the distal end was the persistent omphalomesenteric vessels. This is the view of Ahlfield quoted by Bunts (ANNALS OF SURGERY, V. 40, p. 537), of Halstead and others, and traction by such a band could easily account for such a diverticulum.

The history of previous attacks of severe colic, the sudden onset, the localization of pain below and to the right of the umbilicus, the moderate distention, obstruction all but complete and intestinal vomiting probably should have suggested the character of the obstruction, but so similar are the symptoms in some other forms that only a diagnosis of obstruction was made.

In addition to the other symptoms, the yielding tenseness in the anterior part of the abdomen on vaginal examination is important, showing in the absence of fluctuation unusual intestinal distention.

The frequency of obstruction from this cause is figured at 5 per cent., and the mortality at over 50 per cent., in operated cases, while taking all cases it is 60 per cent., or more. The fact that in many cases at operation the cause has not been discovered, as shown at autopsy; and that the mortality in all operated cases is so high, should emphasize the need for early opera-

tion in all cases of obstruction. The diverticulum is found in about 2 per cent. of cases. A recent report by O. M. Gilbert, in the *Journal of the American Medical Association*, May 26, 1906, shows in nearly 100 autopsies 5 per cent.

Constriction was by band in 101 of 184 cases reviewed by Miles F. Porter (*Journal of the American Medical Association*, Sept. 23, 1905), and the average age of patients about 21 years, with greater frequency in males.

It is probable that traumatism is the exciting cause in some cases, as are undoubtedly overeating and flatulent indigestion. These especially figure in etiology in diverticula with attached bands. While a review of reported cases show very few diagnoses prior to operation, there is a history of abdominal crises in many; and late operation is the only explanation of the heavy mortality. Therefore, early operation should be the rule when obstruction occurs and interval exploratory operation should be done when attacks are recurrent.

In operations for appendicitis, when that organ is found healthy the ileum should be investigated, otherwise the cause of the symptoms may be overlooked. At operation the diverticulum should be excised, as a rule, but where it is little more than an enlargement of the ileum and the patient in bad condition, as in this case, there is justification for leaving it, after removing the constricting band. The danger of trouble from the remaining small diverticulum of this type from inflammation, invagination or torsion is infinitely less than from an appendix vermiformis, and yet we do not advocate removal of an appendix in every abdominal operation as a preventive measure.

As to the rarity of intussusception, Kammerer (AN. SURG., Aug., 1897) cites only two, which have been often referred to, from Treves. Gibson, quoted by Wainwright (AN. SURG., Vol. 35, p. 33) does not mention this form in 239 cases of intussusception, detailed—or in 1000 cases of intestinal obstruction.

Volvulus would be clearly impossible in a very short diverticulum with a mesentery and diverticulitis would likewise be very unlikely.

DR. A. E. HALSTEAD stated that statistics showed that next to intussusception obstruction from diverticulum is the most common form of obstruction of the bowel. The statistics of Lichtenstein showed that 39 per cent. of obstructions are caused by

intussusception and 6 per cent. by diverticulum. He thought that Dr. Harsha's case was of considerable interest because the constricting band had been present from birth and did not produce obstruction for many years. The immediate cause of obstruction was undoubtedly some acute distension of the bowel above the point of constriction, which happens frequently in these cases, especially when the loop of bowel is suspended by a diverticulum from the umbilicus. When the loop becomes overdistended the weight of the suspended loop will cause a twist in the gut or constriction or other acute complication and there is an obstruction. When the diverticulum is free the chances for a constriction are comparatively slight.

He thought that not removing the diverticulum is a mistake. There are on record some thirteen or fourteen cases of obstruction occurring from invagination of the diverticulum. In some of these cases the diverticulum was only a small pouch but it was sufficient to act as starting point of an intussusception, which later caused a complete obstruction. It is therefore always advisable to remove the diverticulum, no matter how small it may be, by cutting it off flush with the intestinal wall and closing the opening with suture. These diverticula that cause obstruction by invagination do so in different ways. In some the mucous membrane loosens and alone projects into the lumen of the gut. In others the whole diverticulum is invaginated, and in still others the diverticulum weakens the wall of the gut so that a segment above the diverticulum is invaginated into the gut below.

GANGRENE OF LEG FOLLOWING RHEUMATIC ENDOCARDITIS—AMPUTATION.

Dr. William M. Harsha reported the history of a woman aged fifty-two who had had occasional attacks of articular rheumatism since the age of seventeen; otherwise healthy; no arteriosclerosis. March, 1904, suffered an acute attack of articular rheumatism hands and feet swelling first. Various joints of extremities were successively affected until the second week, when endocarditis developed, the extremities improving except that some pain continued in right leg and knee. Suddenly there was an accession of pain in leg, which soon changed color, and beginning gangrene appeared in toes and foot.

Dr. Harsha first saw her with Dr. Lodor, of this city, April 13, 1904, when the discoloration had extended above the ankle. Left leg and foot were normal. Valvular murmurs were present in heart, but circulation seemed strong. The rheumatic symptoms had otherwise subsided and temperature was normal. April 23, 1904, he amputated at the junction of middle and upper thirds of thigh, the main artery being found closed with blood-clot up to that point.

At time of operation, Lakeside Hospital, April 23, 1904, very slight valvular sounds could be heard, otherwise organs were healthy, barring a trace of albumin in the urine. Healing was slow, the wound sloughing in a portion of one flap, and slight necrosis of end of bone followed without apparent infection, but apparently from insufficient blood-supply.

No microscopic examination of the artery was made. It appeared at each of several places opened, as a typical thrombosis or coagulum of blood; and in gross appearance the artery appeared free from inflammatory changes. The patient made a complete although slow recovery and has remained well.

His conclusion was there were vegetations or thrombi about the valves as a result of the endocarditis, which became dislodged and occluded the lower end of the popliteal, at the bifurcation probably.

SPONTANEOUS FRACTURE OF THE FIBULA.

Dr. William M. Harsha reported the history of a man, aged 40; referred by Dr. G. V. Wyland. Father died at ninety-seven of old age. Mother living, eighty-seven. One sister died of typhoid at age of thirty-eight. One brother operated on for tuberculosis of testicle. One brother died from injury to back from heavy lifting, after several months.

Personal History.—Fell in a well at thirteen years of age, bruising left leg, following which had osteitis or periostitis, probably tubercular, lasting three years. At operation removed most of tibia. Since that has been well. Left leg five inches shorter than right. Knee presented appearance of backward displacement of bones of leg. Patient walked with cane and steel extension shoe. Was strong enough to carry weight of 100 pounds or more, and seemed entirely well. Five weeks ago went down town, and on entering a barber shop, while walking, felt bone of

Gangrene of leg.

leg break. A plaster bandage was put on by Dr. G. V. Wyland, but at end of four weeks there seemed no effort at union, and patient desired amputation.

Amputation by short lateral flaps through knee joint, at West Side Hospital, June 6, 1906. Upper two-thirds of tibia absent. Head of fibula in popliteal space, just above and slightly to inner side of external condyle of femur. Patient has made rapid recovery, sitting up before the end of a week.

Specimen shows absence of tibia, with great increase in size of fibula. Dr. W. A. Evans after having examined some decalcified pieces of the fibula, found no evidences of sarcoma, carcinoma or tuberculosis.

The fibula shows increase in size, compensatory, and appears more than usually porous. Patient is well nourished, with no organic nerve disease, cancer, diabetes, specific trouble or premature senility. Owing to the feeble articulation behind the outer condyle, it is probable that partial loss of function accounted for the weakness.

SARCOMA AND MYOMA OF THE STOMACH.

Dr John L. Yates, of Milwaukee, by invitation, read a paper with the above title (for which see page 599).

Dr. A. J. Ochsner said that the fact of finding three tumors of the stomach that were not carcinomatous within a short time tended to show that these tumors are much more common than has hitherto been supposed, and that tumors which are sarcomatous or myomatous may be diagnosed as being carcinomas. This seems to be important from the fact that the stomach is fairly well protected against transmission of sarcoma to the surrounding tissues. The sarcoma seems to remain more limited than does carcinoma, so that the end results should be better after gastrectomy in sarcoma than in carcinoma.

Regarding the case of sarcoma of the cæcum, he directed attention to a few points in the technic of its removal. The method of removal is comparatively simple, provided the operator bears in mind a few points. The healthy end of the colon can be inverted precisely as can the duodenum after gastrectomy, provided one goes back far enough from the tumor, the loss of a few inches of bowel being insignificant. It is important to bear in

mind the fact that the duodenum comes over to the right near the ascending colon.

Heretofore he has always made the anastomosis between the ileum and colon with the Murphy button, with a few exceptions. In the case reported by Dr. Yates it was made with the needle and thread, a method he has employed lately for everything. He removed the cæcum and ascending colon to the hepatic flexure, together with three or four inches of the ileum.

Dr. A. E. Halstead cited the case of a young man seen a few years ago with a movable tumor of the stomach. He had no stomach symptoms, excepting epigastric soreness occasionally. He operated on the man and found a pedunculated tumor of the size of a small orange, which resembled a foreign body more than a tumor. The tumor was attached to the smaller curvature. The portion of stomach giving attachment to the tumor was excised, and the patient made a complete recovery. The patient disappeared so that it has been impossible to learn whether or not a recurrence took place. Microscopic examination showed the tumor to be a round-celled sarcoma.

Dr. D. A. K. Steele has seen a number of cases of sarcoma of the stomach, but they were secondary. All the patients died. The first patient was a young man, eighteen years of age, who received a blow on the right testis while playing ball. This was followed by inflammation and the development of a sarcoma. The testis and cord were removed thoroughly and carefully, but within a few weeks there was involvement of the mesenteric glands, and in four months the man had a large sarcoma of the stomach which proved fatal in a few weeks.

Another patient was twenty years of age. He received an injury of the inner condyle of the femur, which was followed in a few weeks by the development of an osteosarcoma. The leg was amputated at the middle of the femur and the patient made a good recovery, but in four or five months sarcoma developed in the flexor muscles of the forearm following unusually severe exercise. The muscles were removed and the man was well for three or four months, when he developed a sarcoma of the stomach which caused his death, about sixteen months from the time of appearance of the primary tumor of the femur.

Dr. E. W. Andrews agreed with the remark about the possibility of there being a greater number of sarcomata of the

stomach than was supposed. He thought that this might be of clinical importance in changing the attitude of the profession toward gastro-enterostomy in cases where radical removal is impossible. He did not agree with Drs. Mayo and Billings and others who condemn palliative operations on the stomach. When only one out of many cases is benefitted, it is worth while having operated. It is possible that only in these cases of sarcoma of the stomach life may be much prolonged and a patient who lived for years after the operation for removal of a malignant growth of the stomach in all probability had a sarcoma and not a carcinoma. We do not commonly get a microscopical diagnosis when we merely do a palliative operation, leaving the tumor. We could do so, and ought to do so hereafter, instead of assuming them all to be carcinoma.

Dr. Yates called attention to Fenwick's statistics showing that in a series of 500 cases of tumor of the stomach, sarcoma was present in two to four per cent. Of six or eight patients that have been operated on by thorough extirpation, 40 per cent. were alive at intervals of from two to twenty-four months after operation. It is impossible to state whether the tumor was a spindle-celled or a round-celled sarcoma. In the former the prognosis is better than in the latter. As a rule, they grow from the external side of the submucosa, grow outward and have less tendency to produce metastasis. The excision of these tumors is followed by better results than is excision of the round-celled variety, which begin from the inner side of the submucosa and tend to recur or metastasize.

REVIEWS OF BOOKS.

BODILY DEFORMITIES. By E. J. CHANCE. Edited by JOHN POLAND, F. R. C. S. London: Smith & Co.

This is the second edition of a series of lectures delivered by the late Mr. Chance to his students over fifty years ago and edited by his associate, Mr. Poland, and, by the editor's comments in foot notes, brought more up to date. There is much interesting reading and many good suggestions to be derived, but it would seem to the American reader at least that a good deal more of the original lectures might well have been omitted, especially some of the discussions on controverted points. The introduction deals with the history of the development of specialism in general as well as of orthopedics, which, being written in the early beginning of this specialty is instructive, and also, in the light of present day knowledge, amusing. In the following six lectures, which make up this first volume, the author discusses the causes of congenital and acquired deformities. The book gives a profound and scientific study of the etiology and pathology of the subject, including a discussion of the hereditary and emotional influence on the development of the ovum, and the causation of congenital deformities from arrest of development, mechanical interference, and disease in utero. The last two lectures treat of acquired deformities, taking up rhachitis and tuberculosis—the latter very briefly—and dealing at length with the causes affecting the contractile power of muscles, resulting in paralyses, spasmodic action and contractures. The illustrations are numerous, but seem very crude in comparison with the finished reproductions of photographs in modern works. The reader will be well repaid by its perusal, but must wonder how many volumes would be required if the subject were treated as exhaustively to-day. There is much however, relative to the etiology, which recent treatises on orthopedic surgery do not attempt.

CHARLES DWIGHT NAPIER.